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ABSTRACT

The Science Career Awareness Training (SCAT) program proved effective as a means of increasing knowledge about science careers and interest in science as a career for students in the late elementary school grades (grades 4-6). Thus, the SCAT program influenced the knowledge and motivation bases of career choices. However, participants in the program became more indecisive as far as career choices were concerned. Among these students, certain stereotypic career-choice behaviors were already apparent suggesting that programs such as SCAT should start even earlier. The SCAT program uses a highly-interactive, computer-based system to provide information about science career areas. The information is presented in the form of 30-minute dialogs. The dialogs present both printed information and photographs, as well as problem-solving experiences. The topics of the dialogs are: (1) science careers in general; (2) the engineer; (3) the chemist; (4) the physicist; (5) the earth scientist; (6) the biologist; (7) the mathematician; (8) the social scientist; and (9) the health scientist. (Author/BB)

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ED162894

A STUDY OF THE USE OF COMPUTERS IN THE DEVELOPMENT OF SCIENCE CAREER AWARENESS IN ELEMENTARY SCHOOL CHILDREN

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MONTGOMERY COUNTY PUBLIC SCHOOL SYSTEM

SE 025 418

A STUDY OF THE USE OF COMPUTERS IN THE DEVELOPMENT OF SCIENCE CAREER AWARENESS IN ELEMENTARY SCHOOL CHILDREN

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July 1978

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This report is the culmination of a great deal of planning, coordination and thought. It also represents lots of just plain hard work--data collection, coding, reduction, analysis and interpretation. It was truly a team effort by members of both the Gibboney Associates and the Montgomery County Public School System (MCPS) staffs. So many people contributed to the successful completion of this project that it is difficult to know where to begin. Therefore, I'll begin with the obvious--my coauthors. First to Dr. Patricia Sweeney for her extraordinary efforts in every aspect of the project from the creation of the dialogues to the data analysis--and everything in between. Her energy and creativity were inspirations to us all. Joanne Marshall-Mies came aboard in the latter stages of the project but soon enough for it to benefit from her keen analytical ability and superb writing skills. For Victoria Anderson-Mayo, no job was too formidable to tackle or too tedious to complete.

The interface with the school system was initially with Dr. William Richardson who helped in the early stages of the program and later with Mrs. Catherine Morgan, who became Co-Principal Investigator for virtually the entire duration of the project. Her contribution to both the technical (computer) and management aspects of the project were invaluable. The other members of the MCPS part of the team all gave unselfishly of their time, professional talent, and personal commitment. Patricia Cutlip wrote dialogues, held orientations for MCPS staff, and helped implement the program in the schools. Shirley O'Neill singlehandedly did all of the programming. Dave Bass assisted Dr. Sweeney in the program implementation and data collection.

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Finally, my appreciation to two other people who made the study possible--Mr. Lawrence H. Oliver, of the National Science Foundation, for allowing us to start the study, and Dr. Richard West of NSF for allowing us to complete it. I hope in reading this report they share my feelings that it was a study well worth doing.

Arthur L. Korotkin, Ph.D.
Principal Investigator

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A STUDY OF THE USE OF COMPUTERS IN THE DEVELOPMENT OF SCIENCE CAREER AWARENESS IN ELEMENTARY SCHOOL CHILDREN

SUMMARY

The fact that minority groups and women are underrepresented in science careers is an indisputable fact. In a recent study by the National Academy of Sciences they found that of the 244,900 scientists holding doctorate degrees, only five percent were members of minority groups and nine percent were women. The reasons for this underrepresentation are numerous and complex. They are tied to the very foundations of our culture, our educational and career guidance systems. It is but a single manifestation of the systematic and deeply ingrained pressures that are brought to bear upon members of minority groups and women to fulfill certain role expectancies in our society, including those found in the world of work. These roles are defined early in life, and the pressures, both overt and subtle, begin to shape the patterns of behavior so as to fit the model defined for them.

The overall purpose of this project was to experimentally assess the effects of disseminating science career information via a unique computer-based system called the Science Career Awareness Training (SCAT) program to children in the upper elementary grades (4, 5, and 6). It was expected that by providing interesting and innovative interactive career dialogues and career simulation activities, all children, regardless of sex or race, would increase their knowledge and possible interest in science as a possible career.

It was found that the SCAT program did in fact prove to be effective as a means of increasing knowledge about science careers and interest in science careers for students in the late elementary school grades. It may be that such an innovative program should begin even earlier since stereotypic career behavior patterns seem to be already present in the students who participated in the study. Once a student enters school, his/her decisions begin to reflect these stereotypes so that by the time they enter secondary school, many career options are already out of reach unless drastic remedial measures are taken. Early intervention measures, such as SCAT, may slow down or even reverse these trends.

A STUDY OF THE USE OF COMPUTERS IN THE DEVELOPMENT OF SCIENCE CAREER AWARENESS IN ELEMENTARY SCHOOL CHILDREN

INTRODUCTION

The fact that minority groups and women are underrepresented in science careers is an indisputable fact. No matter what the source, the data to support this conclusion are consistent and irrefutable. In a recent study conducted by the National Academy of Sciences of the 244,900 scientists who hold doctorate degrees, only five percent were members of minority groups and nine percent were women. Of those scientists in the study classified as minority group members, only 15 percent (of the five percent) were Black. Of the women scientists included in the survey, 75 percent (of the nine percent) had their degrees in biological and social sciences.

The reasons for this underrepresentation are numerous and complex. They are tied to the very foundations of our culture, our educational and our career guidance systems. It is but a single manifestation of the systematic and deeply ingrained pressures that are brought to bear upon members of minority groups and upon women to fulfill certain role expectancies within our society, including those found in the world of work. These roles are defined very early in life and the pressures, both overt and subtle, begin to shape the patterns of behavior of the individuals so as to fit the model defined for them.

In examining the problem of the disproportionately low representation of minority groups and women in science it is apparent that the career choices are not made when entering college. Rather, it seems that career decision-making is a continuing and iterative process beginning early in life and continuing through our adult years (Borow, 1966; Lazarsfeld, 1931; Super, 1957; and Tiedeman and O'Hara, 1963). Thus, if career selection is to be influenced, such an influencing process must begin in the early formative years. However, until recently, very little had been done in career education at the elementary school level. The few programs and materials which have been tried are not based on solid and fundamental knowledge concerning the development of career interests, aptitudes, attitudes, and ambitions of young children since little is known about these most basic issues.

Philip Rever (1973) in a recent review of the research concerning the factors influencing the development of scientific and technical careers during the educational years reported that despite the efforts of researchers such as Roe (1952, 1957, 1961), Cooley (1958, 1963), Eiduson (1962), and Super (1957a, 1957b, 1960), very little is known about the relationship of a child's area of interests, ability levels, or aspirations and success in preparing for and entering scientific occupations. More specifically, little is known about the effects of schooling; personality; environment to include the influence of social class, community, religion, family structure; interests; and, levels of cognitive development on stimulating a young child's interest (especially children in grades K-8) in scientific and technical careers. In addition, in his review of career development research in progress at the time of his study, Rever reported that few studies were being conducted to explore the nature of career development of scientists and technicians during the school years, and more specifically no studies were being undertaken to assess the nature of career development of minorities and women in the sciences.

An extensive review of the research published since Rever's study confirms his findings. Though some research has been undertaken during the last few years in the assessment of young children's attitudes toward science (Motz, 1970; Ralph, 1972), the vocational development of children in the early years of schooling (Fulton, 1971; Vondracek and Kirchner, 1974; Ansell and Hansen, 1971), the effect of vocational information on career development of elementary school children (Harkness, 1973), and a review of research on developing science careers (Eiduson and Beckman, 1973), few definitive and supported conclusions can be presented concerning the factors influencing a young child's career development and specifically the development of interests and attitudes toward science careers.

Computer-Aided Career Counseling

One promising area of research in career education that was not reviewed by Rever is the use of computers to assist in the guidance process. Since the late 1960's over 30 different computer-based guidance information systems have been devised to serve the education and career information needs of secondary school students (Harris, 1974). Harris found that in general these systems were built upon the notion that the more information a high school student has concerning careers, the better his or her vocational choice.

Because of its large memory capacity and ability to access and retrieve a vast amount of stored information, the computer offers numerous benefits to the student and the counselor. First of all, the computer becomes a primary source of information that is always there for all students according to their individual needs, interests, and avenues of inquiry. Besides accessibility, the computer offers to all students any part of its stored information without bias or partiality. In this capacity the computer can meet the user (or learner) at his or her own level utilizing a variety of learning resources to include visual graphics, randomly-accessed audio and visual displays, rapid feedback, and diagnostic and prescriptive responses to student inquiries. Most importantly, the computer disseminates information in both an untiring and nondiscriminating fashion. The computer can respond equally effectively to a career question whether it has been asked once or a thousand times within the course of an hour. Of particular relevance to this study, the data provided by the computer are consistently accurate and unchanged regardless of the race or sex of the child requesting the information. In addition, when used in the "interactive mode", the student becomes an active participant rather than a passive observer.

Despite the potential usefulness of computers in guidance and counseling, at last count only seven direct inquiry systems were in operation (Bowlsbey, 1975). Bukoski and Korotkin (1975) reported in their survey of computer use in secondary schools that only about 9% of the schools surveyed used a computer in a "counseling and guidance" process. In addition, there are several systems at the post secondary school level developed by the U.S. Army (Conmy, Tiedeman, and Korotkin, 1973), and U.S. Navy (Rafacz, 1976) and the U.S. Department of Labor (U.S. Department of Labor, 1977). Though each system has its own unique characteristics, in general all of them serve to disseminate information about vocations, careers, and educational opportunities. In addition, all of the school-based systems have as their target population students in the later educational years (grades 7-12+). In a recently completed review of the literature by P. C. Cairo (1977) only one elementary school project was identified and that had to do with simulated games and their implication for guidance (Brown and MacDougall, 1971). A review of the proceedings of the IFIP Second World Conference on Computers in Education (International Federation of Information Processing, 1975) turned up no projects in computer-aided counseling aimed at the elementary grades.

It would appear that until the current study was initiated, no computer-based system had been devised to assist in the process of information dissemination specifically in the elementary schools, nor had any research been conducted to indicate whether such an approach would have a demonstrated impact on elementary students who are at that critical period when they are just beginning to explore the question of who they are and what the world of work is all about.

APPROACH

The SCAT System

Richard A. Gibboney Associates, Inc., in collaboration with the Montgomery County Public School System developed and conducted a unique computer-based system called the Science Career Awareness Training (SCAT) Program. SCAT involves the utilization of computer technology to provide upper elementary school students the opportunity to explore, on an individual basis, selected careers in science and their possible interest in them. This experimental process for career awareness training utilizing the computer brings together computer technology, science education, and career education. As pointed out in the Introduction, the application of computers to the counseling process is not new or unique. However, the utilization of the computer in the interactive mode as an information source and the application at the elementary school level does set this program apart from any of the work conducted previously or, to our knowledge, currently under development.

It was intended that the information gained from the interaction with the computer would enrich and enhance any information about these science careers previously obtained through experience or contact; and substitute for such experiences for those children who have little or no knowledge about science, the scientific method, and the broad spectrum of science careers. It was thought that this latter group might well include a disproportionately high number of women and members of minority groups in view of the fact that minorities and women are uniquely faced with numerous social and cultural barriers that tend to exclude them from fully exploring many career opportunities. To succeed, Black, Mexican American, Oriental, or Native American children must not only master their own language and cultural patterns but must develop the verbal and social skills deemed important by a predominantly white middle class culture. As a result, minority children tend to be viewed as holding less potential for educational and vocational pathways held in high esteem by American society. Likewise, women must overcome the influences of stereotyping in occupations that are transmitted during their early attempts to identify an appropriate sexual role. Obviously, society is quick to teach the very young that a woman's proper place is in the home, behind the counter, at the bedside in a hospital, or in front of a typewriter.

The overall purpose of the project was to experimentally assess the short-term and long-range effects of disseminating science career information via a computer-based system to children in the upper elementary grades (grades 4, 5,6). It was expected that by providing interesting and innovative career dialogues and career simulation activities, all children regardless of sex or race would increase their knowledge and possible interest in science as a career. Several important issues in career decisionmaking were considered in this research.

The first consideration was that elementary students were introduced to the field of science and to science careers through interactive science career dialogues which included science-oriented problem-solving simulations. Consistent with the psychological characteristics of a child at this stage of cognitive development (ages 10-12), the computer-based science career dialogues and problem simulations were highly "interactive" requiring a high degree of active participation from each of the students. To introduce the students to the world of science, participants in the research interactively accessed a series of science dialogues and simulations averaging about thirty minutes in length and covering eight science career areas. The nine dialogues describe :

- The world of Science and science careers in general
- The work of the Engineer
- The work of the Chemist
- The work of the Physicist
- The work of the Earth Scientist
- The work of the Biologist
- The work of the Mathematician
- The work of the Social Scientist
- The work of the Health Scientist

Each of the science career dialogues provides approximately thirty minutes of student contact time on the computer system. They are written in Coursewriter II on the Montgomery County School System's IBM 370-158 and are presented via a cathode ray tube display with both a typewriter keyboard and light pen for input. The system offers the student the opportunity to interactively access information about each field of science in terms of four dialogue components. The information provided by these components are: 1) an introduction to the science; 2) information about careers in that science; 3) additional information on career opportunities; and 4) simulated problem-solving experiences which are associated with scientists in that discipline. The system gives the student information covering each of these professions through verbal (printed text depicted on the computer's cathode ray terminal), visual (a collection of "non-stereotyped" science related photographs keyed to the dialogues, depicting scientists at work), and problem-solving (the solving of simulated science problems with the guidance of the computer) experiences. Included are each profession's work and job responsibilities; the kinds of people a scientist works with; the places a scientist works; and the type of scientific problems that they might solve as part of their profession (Appendix A presents excerpts from "The World of Biologists" to illustrate the dialogues). A student was considered to have participated in the program after he or she had completed the introductory dialogue and any three of the science career dialogues during the school year.

A second consideration for this research effort was exploration of the relationship between a child's level of cognitive development and the growth and development of career awareness and career aspirations for occupations in science and technology. Toward this end, the research involved a cross-sectional study of children at three grade levels (grades 4-5-6) with the purpose of the investigation to experimentally assess the differences in knowledge and interest in science careers of children varying from ten through twelve years of age. This grade/age range is of particular significance since children during this time are experiencing transitional cognitive development as they move from cognitively operating at the concrete level to more formal and abstract levels of thought (Inhelder and Piaget, 1958).

A third consideration involved the possibility of a differential effect of an individual's mastery, and hypothetically his/her improved confidence and interest in the area of mathematics, on his/her interest and awareness of science as a career. It can be hypothesized that a student's interest in science may be directly affected by his/her level of mastery of mathematical operations. Students who have experienced success in mathematics may be more likely to investigate and generate interest in scientific areas. To date there has been no research at the elementary school level that has explored the relationship of demonstrated skill in mathematics and the development of interest in science and the work of scientists. Therefore, a third major purpose of this study was to explore the effectiveness of SCAT in increasing interest in science careers for students identified as outstanding in math skills and, likewise, for students identified as deficient in math skills.

The fourth consideration, though not a primary focus of the research, was the possibility that the data collected during the study would offer some additional insights on how various occupations are perceived by elementary school students. Of particular interest was the question of sex or race stereotyping, i.e., are some occupations consistently favored or ignored by particular segments of the population? Such behavior would suggest a stereotyped view of that occupation or job--either by race or sex.

The fifth, and probably the most important consideration for this research, was the selection of the target population. Since the focus of this research effort was the development of effective methods to introduce members of minorities and women to the world of science, elementary schools from Montgomery County Public Schools that have a high proportion of minority students were selected for this study. It was the purpose of this research to explore the effects of a nonjudgemental and unbiased computerized system of information dissemination to expand the knowledge levels of all students and to motivate students who might ordinarily not be considered as possessing potential for entrance into college-bound and science-oriented educational programs at the junior or senior high school level. In essence, the research was expected to demonstrate that many students may develop an interest in pursuing a science career, if introduced to that career possibility in an effective way and at an appropriate time during their educational years.

Overview of SCAT Program Implementation

The SCAT program encompassed two academic years (1975-76 and 1976-77). The two-year period allowed for the development of SCAT dialogues and instruments to measure key variables. It provided adequate exposure to the SCAT dialogues and an opportunity to assess both the short-term and long-term effects of the program.

The SCAT project was initiated on June 1, 1975. It began with the design, writing, programming, pilot testing and refining of the SCAT dialogues. Initially, SCAT consisted of eight dialogues: one dialogue on the general world of scientific work plus separate dialogues for the work of the engineer, chemist, physicist, earth scientist, biologist, mathematician and sociologist. A second aspect of the project proceeded concurrently with the dialogue development: the development and/or adaptation of instruments to measure key variables. Within seven months the initial dialogue and instrument development phase was completed.

Actual implementation of the SCAT system within the schools began in January 1976. Orientation sessions were held for the principals and administrators, and workshops were held for the teachers and other relevant personnel from the schools. Upon completion of the orientation and training, baseline data (pretests) were collected from all students (both SCAT and NO-SCAT or control students) involved in the study.

Students in the SCAT group then received a general orientation to the program and the use of computer terminals. The research staff took each SCAT student on an individual basis through the introductory dialogue concerning the use of the computer and a general introduction to science careers. Following this orientation, each student was required to choose and complete any three of the seven available dialogues on specific science occupational areas. These dialogues were completed over a period of four to six weeks by the students, working on their own and being sent to the terminal by the classroom teacher. Students were permitted to drop each dialogue after the introduction and to choose another if he or she had no interest in that area. The completion of three full dialogues fulfilled the study requirement. At the end of three dialogues the student was not permitted to continue during the first year -- thus exposure to SCAT was kept constant for all students.

During the period of student exposure to the SCAT dialogues some minor modifications were made to the test instruments. Once all SCAT students had completed three dialogues, the revised test instruments were administered to both the SCAT and control students. The pretest/posttest time interval varied from six to eight weeks, keeping the interval the same for all students within a given grade.

The summer of 1976 allowed time for analysis of the first year data and reflection on student reactions to SCAT and the test instruments. Based on this experience, several modifications to the program were made. First, the computer experience during the first year led to modifications in the science career dialogues. The major changes consisted of broadening the "Sociologist" dialogue to "Social Scientist" and adding a new dialogue on "Health Scientist". Minor dialogue changes involved replacement of vocabulary and the addition and/or revision of simulated work samples. Secondly, the data collection test/retest instruments were revised. All changes were completed prior to the beginning of the second school year (1976-77).

The second phase of SCAT began in January 1977, following the same implementation procedures. Several new schools which had been added to the program received an orientation similar to that given to the first-year schools. All students, including new students and those who had participated in 1976, were given the revised pretest instruments. New SCAT students were taken through the introductory dialogue concerning the use of the computer and a general introduction to science careers. Then, each new SCAT student completed three dialogues and each SCAT student who had participated in the first year completed three additional dialogues. At the close of the project, all students (both SCAT and control) were given the posttest instruments.

The description presented above was intended to provide the reader with an overview of the SCAT program implementation. The following section, Research Design, presents a detailed description of the research goals and hypotheses, evaluation design, sample selection, measurement of key variables and analyses of the data.

RESEARCH DESIGN

The primary goal of this research was to evaluate the effectiveness of SCAT in providing students with accurate information about careers in science as a basis for making mature, knowledgeable career decisions. Secondary goals were to evaluate the effectiveness of SCAT in increasing student interest in science as a career, increasing student career maturity including their career choice realism, and decreasing the effect of cultural career stereotypes on selection of science careers. Finally, it was of interest to examine the relationship of the factors mentioned above to each other.

Hypotheses

Specific research hypotheses related to the research goals were constructed as follows:

Concerning Knowledge About Science Careers:

> Students who are exposed to the SCAT dialogues are more likely to have greater knowledge about science careers than those who are not exposed to SCAT dialogues.
>
> The knowledge gap between males and females and between whites and minorities is more likely to be decreased for students who are exposed to the SCAT dialogues than for those who are not exposed to the SCAT dialogues.

Concerning Interest in Science as a Career:

> Students who are exposed to SCAT dialogues are more likely to express interest in science as a career than those who are not exposed to SCAT dialogues.

Concerning Career Maturity:

> Students who are exposed to SCAT dialogues are more likely to increase in career maturity than those who are not exposed to SCAT dialogues.

Concerning Cultural Career Stereotypes:

> Students who are exposed to SCAT dialogues are less likely to select a career according to cultural career stereotypes than those who are not exposed to SCAT dialogues.

Concerning Realism of Career Choice:

Students who are exposed to SCAT dialogues are more likely to make realistic career choices than those who are not exposed to SCAT dialogues.

Concerning Interrelationships Among the Variables:

The relationship between knowledge about science careers and interest in science as a career and between knowledge and career maturity is likely to increase over time as students acquire more knowledge about science careers. Also, there is a positive relationship between competency in mathematics and knowledge about science careers, interest in science as a career and career maturity.

Evaluation Design

The research methodology was designed to test the hypotheses stated above. The original experimental design for the evaluation was a simple treatment (SCAT versus NO-SCAT students) by grade (4th versus 5th versus 6th) by sex (male versus female) by race (white versus minority) design as shown in Figure 1.

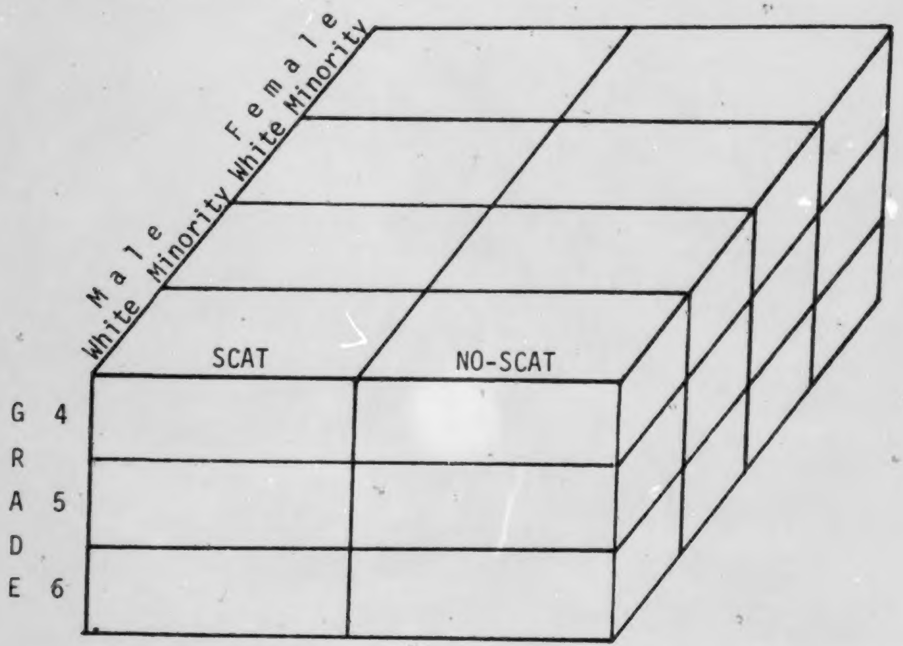


Figure 1. Experimental design for evaluation of the SCAT program.

The program effects were to be ascertained by test-retest (pre/post) measures of key variables.

Sample Selection

The experimental design presented above placed certain constraints upon the selection of sample schools. The primary constraint related to the fact that one of the groups at which the program was targeted was minority students. Thus, it was decided to oversample that segment of the school population so the percentage of minority students in the program was intentionally higher than the percentage of minority students in Montgomery County. It should be noted that for the purposes of this study the Montgomery County Public School System's definition of "Minority" is used to include Blacks, Mexican Americans, Spanish Surname and East Asians. The term "White" includes all other students.

To maximize this concentration of minority group members in the sample, schools were selected in geographic areas of Montgomery County having a high proportion of low and middle income residents. Four experimental schools were selected at random from a candidate list of schools. Four additional schools similar in ethnic and minority composition, socioeconomic status, and standardized test scores in reading and mathematics were selected as NO-SCAT or control schools.

Several schools in the area already had Computer-Assisted Instruction (CAI) terminals for use in a mathematics program. The experimental and control samples each contained two such schools. The CAI mathematics program was remedial in nature and thus had to be taken into consideration in the study design. Rather than being considered an independent variable, participation in the CAI mathematics program was a controlled variable with participants equally represented in the experimental and control groups. In this way, familiarity with computer use and need for remediation in mathematics would be approximately equal for both groups.

In addition to assessing the effectiveness of SCAT on members of minority groups and females, the study also attempted to examine the differences in knowledge and interest in science careers of children of varying ages. Thus, the study population consisted of a cross-section of children at three grade levels (4-5-6) within the selected schools.

One unanticipated problem over which we had no control occurred at the end of the first year of data collection. Because of the nature of the study, i.e., a concentration on the effectiveness of science career awareness training on women and members of minority groups, the schools in the study had been selected on the basis of high minority enrollment. During the summer between the first and second years of the project, a desegregation plan was implemented in Montgomery County, Maryland,to achieve better racial balance in the elementary schools. Since the study had deliberately chosen schools with high minority enrollments, two of the four experimental schools and two of the four control schools were affected by the desegregation plan and by school closings. The two new experimental schools selected for the study were those in which the majority of the previous program participants were assigned. The overall impact of this change was a reduction in sample size of those children who participated in the program for the full two-year cycle of the project. Nevertheless, a sufficiently large sample size was retained so as to make all the data analyses meaningful and valid.

As designed, the sixth grade students left the program after the first year and a new group of fourth grade students entered the program after the first year. Thus, only the fourth and fifth grade students from the first year could have two years of exposure to SCAT. Two-year data were collected on 75 percent of the SCAT and 58 percent of the NO-SCAT students in the first-year fourth and fifth grade groups.

Three distinct samples emerged from the study:

- The 1976 3-dialogue sample included all students who participated in the study during its first year. These students were in the 4th, 5th and 6th grades in 1976. The SCAT students selected and experienced three of the seven science dialogues; NO-SCAT students were not exposed to the dialogues. This sample was used to evaluate the short-term and long-term effects of exposure to three SCAT dialogues.

- The 1976-77 6-dialogue sample consisted of all students who participated in the study for two years. These students started the study in 1976 in the 4th and 5th grades and ended it in 1977 in the 5th and 6th grades respectively. All SCAT students selected and experienced six of the eight science dialogues; NO-SCAT students were not exposed to the dialogues. This sample was of primary importance since it alone provided the basis for an evaluation of the impact of exposure to the complete SCAT program. SCAT program effects were expected to be most dramatically demonstrated for this group.

- The 1977 3-dialogue sample included all students who participated in the study for the first time in 1977. These students were in the 4th, 5th and 6th grades in 1977. SCAT students selected and experienced three of the eight science dialogues while NO-SCAT students were not exposed to the dialogues. This sample provided a basis for validating the short-term effect of exposure to three SCAT dialogues.

The total number of students in each of the three samples follows:

Sample		SCAT	NO-SCAT
1976	3-dialogue	345	294
1976-77	6-dialogue	176	109
1977	3-dialogue	192	253

Table 1 presents the final sample sizes on which analyses were performed by grade, by sex and by race.

Table 1. Sample sizes on which data analyses were performed.

	SCAT				NO-SCAT			
	Male	Female	White	Minority	Male	Female	White	Minority
1976 3-dialogue								
Grade 4	56	59	69	46	36	58	62	32
Grade 5	62	58	78	42	36	62	67	31
Grade 6	55	55	68	42	48	54	73	29
Total	173	172	215	130	120	174	202	92
1976-77 6-dialogue *								
Grade 4	40	43	58	25	18	32	33	17
Grade 5	54	39	69	24	17	42	42	17
Total	94	82	127	49	35	74	75	34
1977 3-dialogue								
Grade 4	58	61	101	18	53	55	75	33
Grade 5	19	22	36	5	33	31	53	11
Grade 6	15	17	28	4	43	38	62	19
Total	92	100	165	27	129	124	190	63

---

* Grade during first year of study.

Measurement of Key Variables

It is often easier to conceptualize the key variables in a research study than it is to operationally define them, particularly when the study is geared to a population on which little previous research has been conducted. This was the case in the SCAT study--that is, since elementary school students were the target population and since most of the prior research in career awareness and decision-making had been conducted on secondary school students, there were few reliable instruments available. As a result, in most instances, the research team had to develop instruments by which the key variables could be measured. The following section describes the development and or adaptation of instruments to measure key variables and the scores derived from them. (Final versions of the instruments developed by the research team are contained in Appendix B.)

Knowledge About Science Careers

To operationally define knowledge about science careers for research purposes, the research team developed a 24-item test entitled, "Knowledge About Science Careers" for use as the 1976 pretest instrument. This test, which utilized both matching and multiple-choice formats to elicit responses from the students, consisted of several items covering information from the "Introduction to the SCAT Dialogues" and several items devoted to each of the science dialogues. The same test, with some items slighly reworded, was used as the 1976 posttest instrument. In 1977, the test was again revised, this time into a 26-item multiple-choice test. The revised test served as both the pretest and posttest instrument in 1977.

For each test, the total test score was equal to the number of items answered correctly. Thus, there were four distinct test scores:

- Pretest 1976
- Posttest 1976
- Pretest 1977
- Posttest 1977

In addition, three Knowledge Growth scores were derived from the raw scores as follows:

- '76 pre to '77 post Growth score equaled the 1977 posttest total score minus the 1976 pretest total score. This represented growth in knowledge about science careers over a two-year period. It was used to compare those who had been exposed to the complete SCAT program (6-dialogues) with those who had no exposure to SCAT.

- '76 pre to '77 pre Growth score equaled the 1977 pretest total score minus the 1976 pretest total score. This represented the long-term growth in knowledge about science careers and was used to compare those exposed to three SCAT dialogues to those who had no exposure to SCAT.

- '76 pre to '76 post Growth score equaled the 1976 posttest total score minus the 1976 pretest total score. This represented the short-term growth in knowledge about science careers and was used to compare those exposed to three SCAT dialogues to those who had no exposure to SCAT.

Interest in Science as a Career

The development of an instrument to measure interest in science as a career proved to be much more difficult than developing an instrument to measure knowledge about science careers. In 1976, Gibboney Associates developed an occupational attitude and interest inventory entitled, "Things I'm Interested In". The format of this science interest test instrument presented several problems during the 1976 pretest period including: (1) scoring difficulties due to the wide variability of items checked; and (2) socioeconomic and racial bias of items. As a result, the interest section of the test instrument was revised prior to its use as a posttest. The revised test, used as the posttest, correlated .58 with the original pretest instrument, making it very difficult to interpret changes in the science interest scores. These science interest questions were further revised for the 1977 testing portion of the study; the same form, however, was used for both the pre and posttests in 1977. The final version of the interest instrument consisted of four distinct parts, each examining the student's interest in science in a slightly different way. These four parts were:

- Science Career Interest was measured by ten forced-choice items in which students chose between science and non-science kinds of work. They were asked to "place an (x) beside the things you might like to do when you grow up". For example, "would you like to: (a) teach in an elementary school; or (b) become a science teacher?" Since this part of the test was developed after the 1976 posttest, it was only available for those samples participating in the study in 1977.

- General Science Interest was measured by 30 forced-choice items in which students chose between science and non-science projects and activities. They were asked to "check the one thing you would rather do for each pair of sentences". For example, "would you rather: (a) plan a science fair; or (b) begin a school newspaper?" This part was also developed for the 1977 testing and thus data were not available for the 1976 testing period.

- Interest in SCAT Careers measured how students felt about the eight science careers presented in the SCAT dialogues. Students were asked to circle "YES", "MAYBE" or "NO" when asked if they would like to become each of the eight types of scientists. This part was used in the 1977 testings only.

- Science Career Choice was measured by the item "What is the one thing you really want to be when you grow up?" Answers were keyed for science or nonscience careers. Unlike the other three measures, this question was presented to the students in the 1976 pre and posttests as well as the 1977 pre and posttests.

Total test scores for the Science Career Interest and the General Science Interest parts were equal to the total number of science items checked. Interest in SCAT Careers items were scored by assigning a two (2) for "YES", a one (1) for "MAYBE" and a zero (0) for "NO". The total score was equal to the sum of the eight item scores with a high score indicating more interest in science careers than a low score. For each of these three parts, Science Career Interest, General Science Interest and Interest in SCAT Careers, two total scores were obtained:

- 1977 Pretest
- 1977 Posttest

Science Career Choice yielded a dichotomized score of 2 for students who chose a science or science-related career and of 1 for students who chose a nonscience career. Contrary to the other three interest scores, four Science Career Choice scores were obtained:

- 1976 Pretest
- 1976 Posttest
- 1977 Pretest
- 1977 Posttest

Career Maturity

As mentioned earlier, most studies of career development have been conducted on secondary school populations. As a result, it was difficult to find a test of career maturity which had been developed for elementary school students. Consequently, Gibboney Associates sought to find a reliable test which could be adapted for use with elementary school children. The test selected was called the Career Maturity Inventory, developed by Dr. John O. Crites (Crites, 1965). The test, although geared to older adolescents and young adults--primarily those still undecided about careers--was written at the 6th grade reading level and thus was easily adapted for this study population by slightly rewording a few items and by reading aloud each item and asking the students to circle the response.

The Career Maturity Inventory was designed to examine career choice attitudes and career choice competencies. It consists of a Competency Test with five parts and an Attitude Scale. Only the Attitude Scale was adapted for this study.

> "The Attitude Scale elicits the feelings, the subjective reactions, the dispositions that the individual has toward making a career choice and entering the world of work... More specifically, five attitudinal clusters are surveyed:
>
> - involvement in the career choice process
> - orientation toward work
> - independence in decision-making
> - preference for career choice factors
> - conceptions of the career choice process."
>
> (Crites, 1973, page 3)

Since career maturity is a developmental process and could only be expected to be affected over a reasonable period of time, students were only tested twice: once at time of pretest in 1976 and once at time of posttest in 1977.

The CMI Attitude Scale consists of 50 true and false items. The score was equal to the number of correct items. "The Attitude Scale was initially standardized on high school students, but its empirically-derived scoring key was based on the majority responses (51 percent) of twelfth graders.." (Crites, 1973, page 5). Thus, the score reflects how the students within the sample compare with each other and with high school seniors. Two CMI scores were obtained:

- Pretest 1976
- Posttest 1977

Competence in Mathematics

The Iowa Test of Basic Skills (ITBS), a standardized test used by Montgomery County Public Schools, was used to measure competency in mathematics. This test is given in odd-numbered years; thus, in our sample only students who were in the fifth grade in 1976 (the sixth in 1977) and in the fifth grade in 1977 (the fourth in 1976) had test scores. Two scores were available for the ITBS: Math Concepts and Math Problem Solving.

Table 2 summarizes the data on key variables collected from each of the three samples.

Table 2. Data available for the 1976 3-dialogue, the 1976-77 6-dialogue, and the 1977 3-dialogue samples

	SAMPLES		
	1976 3-Dialogue	1976-77 6-Dialogue	1977 3-Dialogue
Knowledge About Science Careers	X	X	X
Science Interest			
Science Career Interest		X	X
General Science Interest		X	X
Interest in SCAT Careers		X	X
Science Career Choice	X	X	X
Career Maturity Attitude		X	
Math Competency	X	X	X

Design for Data Analyses

The hypotheses were tested using four types of statistical analyses: analysis of covariance, analysis of variance, chi-square analysis, and correlational analysis. In the following section, each of the four types of analyses is described.

Analysis of Covariance

Analysis of covariance was used as the primary statistical analysis tool in this study. The approach was selected because it provides for statistically controlling for initial differences in scores while testing for the differences following "treatment" (the SCAT program). Test scores following SCAT exposure were used as the dependent variable and test scores prior to SCAT were used as the covariate. These scores varied according to the test being analyzed and the sample employed as follows:

- Knowledge test scores

  --1976-77 6-dialogue sample employed three different pairs of variables: (1) 1977 posttest as the dependent variable and 1976 pretest as the covariate; (2) 1977 posttest as the dependent variable and 1977 pretest as the covariate; and (3) 1977 pretest as the dependent variable and 1976 pretest as the covariate. Analyses using these three pairs of variables were designed to respectively examine the effect of the full SCAT program, the effect of exposure to the last 3 science dialogues and the long-term effect of exposure to the first 3 science dialogues.

  --1976 3-dialogue sample used 1976 posttest scores as the dependent variable and the 1976 pretest as the covariate to yield the effect of exposure to 3 SCAT dialogues.

  --1977 3-dialogue sample used 1977 posttest scores as the dependent variable and the 1977 pretest as the covariate to examine the effect of exposure to 3 SCAT dialogues in a second sample.

- Interest test scores

  Only the 1977 3-dialogue sample was used to examine the three continuous variable interest scores: Science Career Interest, General Science Interest and Interest in SCAT Careers. 1977 posttest scores served as the dependent variable while 1977 pretest scores served as the covariate .

- Career Maturity

  The 1976-77 6-dialogue sample was used to evaluate the program effects on career maturity. 1977 posttest scores were the dependent variable while 1976 pretest scores served as the covariate.

For each pair of variables (the dependent variable and the covariate), three separate analysis of covariance models were employed: treatment (SCAT/NO-SCAT) by grade (4/5/6) by sex (male/female), treatment by grade by race, and treatment by sex by race. These models were designed to examine the main effects of treatment, grade, sex and race as well as two-way and three-way interactions.

Analysis of Variance

Knowledge Growth scores for the 1976-77 6-dialogue sample were evaluated using an analysis of variance model similar to the analysis of covariance model presented above. Three analysis of variance models were employed: treatment by grade by sex, treatment by grade by race, and treatment by sex by race. Again, these models were designed to examine the main effects of treatment, grade, sex and race as well as two-way and three-way interactions.

Chi-square Analysis

Chi-square analyses were used to evaluate responses to the "Interest in Scat Careers" and "Science Career Choice" questions. These analyses were designed to answer specific questions as stated below:

- What is the effect of SCAT on stereotypical career choices? "Interest in SCAT Careers" was examined to determine the relationship between participation in the SCAT program and stereotypical career choices. All responses for the 1977 sample were pooled including both SCAT and NO-SCAT to isolate the SCAT science careers which were sex or racially stereotypical. To accomplish this, "YES" and "MAYBE" responses to each of the eight science careers were collapsed and compared with "NO" responses to that career separately for males versus females and for whites versus minorities. Table 3 presents the chi-square formats used in these comparisons.

Table 3. Chi-square formats used to identify stereotypical career choices

	Male	Female
YES/MAYBE		
NO		

	White	Minority
YES/MAYBE		
NO		

Significant chi-squares were used to select stereotypical careers for males/females and for whites/minorities. For these selected careers, pretest and posttest results were analyzed in a similar chi-square analysis separately for the following groups: SCAT pretest, NO-SCAT pretest, SCAT posttest and NO-SCAT posttest.

- What is the effect of SCAT on the selection of science as a career? Science Career Choice responses were examined to determine the relationship between participation in SCAT and the selection of science as the one thing you want to be when you grow up. Each of the three samples (1976 3-dialogue, 1976-77 6-dialogue and 1977 3-dialogue) was evaluated separately in a chi-square analysis which compared pre/post responses for the SCAT and NO-SCAT groups as shown in Table 4.

Table 4. Chi-square format used to evaluate Science Career Choice for SCAT and NO-SCAT groups

	SCAT	NO-SCAT
Science on Post Nonscience on Pre		
Science on Post Science on Pre		
Nonscience on Post Nonscience on Pre		
Nonscience on Post Science on Pre		

- What is the effect of SCAT on the shift in response from pre to posttest as far as selection of science as a career? Science Career Choice responses were examined to determine if SCAT students had more shifts in career decisions than NO-SCAT students. For this analysis the two middle categories from the contingency table presented above were collapsed to represent no change in decision from pre to post and the top and bottom categories were collapsed to represent a shift in career decision from pre to posttest as illustrated in Table 5.

Table 5. Contingency table format used to examine the shifts in career decisions from pre to posttest for SCAT and NO-SCAT groups

	SCAT	NO-SCAT
SHIFT		
NO SHIFT		

- What is the effect of SCAT on the realism of career choice? Science Career Choice responses were examined to determine the relationship between realistic career choices and participation in SCAT. Students were categorized into high and low pretest Knowledge Test scores and into high and low posttest Knowledge Test scores; they were similarly categorized into high and low ITBS test score groups. The science/non-science career choices were compared for the SCAT and NO-SCAT groups as shown in Table 6.

Table 6. Format for examining the realism of career choices for SCAT and NO-SCAT groups

	SCAT	NO-SCAT
Science		
Nonscience		

This analysis was conducted separately for the 1976-77 6-dialogue sample fourth and fifth grades for the following groups: high Knowledge, low Knowledge, high ITBS and low ITBS. Career choice responses for the pretest 1976, posttest 1976, pretest 1977 and posttest 1977 were examined for all groups.

Correlational Analysis

To examine the interrelationship of the variables included in this study, a Pearson correlational analysis was employed. This involved Pearson product-moment correlations for continuous variables and point-biserials for continuous with dichotomized variables.

RESULTS

Findings related to each hypothesis will be presented next. The format will be identical for each hypothesis as follows:

- Brief introductory paragraph
- Restatement of the hypothesis
- List of key variables defined previously in "Research Design" section
- List of samples described previously in "Research Design" section
- Brief description of analyses performed
- Findings

Findings Related to Knowledge About Science Careers

The SCAT program's primary goal was to increase elementary school students' knowledge about science careers. Accomplishment of this goal was considered a step toward helping students make better career decisions--decisions based on accurate information instead of "word-of-mouth" information which may or may not be accurate.

Hypothesis

It was hypothesized that students who are exposed to SCAT dialogues are more likely to have greater knowledge about science careers than those who are not exposed to SCAT dialogues.

Key Variables

Knowledge About Science Careers

Samples

1976-77 6-dialogue sample

1976 3-dialogue sample

1977 3-dialogue sample

Analyses

An analysis of covariance model was used to test the hypothesis. Knowledge total scores, obtained following different implementation stages of the SCAT program, served as dependent variables and appropriate pretest scores served as covariates:

- 1976-77 6-dialogue sample used: (1) 1977 posttest as the dependent variable with 1976 pretest as the covariate; (2) 1977 posttest as the dependent variable with 1977 pretest as the covariate; and (3) 1977 pretest as the dependent variable with 1976 pretest as the covariate.

- 1976 3-dialogue sample used 1976 posttest as the dependent variable with 1976 pretest as the covariate.

- 1977 3-dialogue sample used 1977 posttest as the dependent variable with 1977 pretest as the covariate.

Appendix C presents output from these analyses. Tables include Knowledge Test total score pretest and posttest means and standard deviations for SCAT and NO-SCAT groups by grade by sex and by race. Adjusted means for treatment (SCAT/NO-SCAT), grade, sex and race are also presented. Within the text, adjusted means are presented only when they are different (rounded to whole numbers) from the raw score dependent variable means.

Findings

Initial pretest Knowledge scores revealed that the elementary school students in the sample had not learned many of the basic facts about science careers. This was evidenced by a mean Knowledge Test score of 12 for the 1976-77 6-dialogue and 3-dialogue samples and a mean of 14 for the 1977 3-dialogue sample; on the average, students correctly answered only approximately half of the 26 test items.

Examination of posttest Knowledge Test scores, using the analysis of covariance model, confirmed the research hypothesis that students exposed to SCAT science dialogues will have higher Knowledge Test scores than those who were not exposed to the dialogues. This finding varied slightly depending upon the sample being evaluated--that is, SCAT/NO-SCAT differences were more pronounced for the 6-dialogue sample than for the 3-dialogue samples as shown below.

6-dialogue sample. Exposure to 6 of the 8 SCAT dialogues over a two-year period had a significant impact on Knowledge Test scores. SCAT groups consistently scored higher than NO-SCAT groups on the 1977 posttest when 1976 pretest scores were taken into account (Table 7). These SCAT/NO-SCAT differences obtained for males, females, minorities, whites and for 4th and 5th graders.

Table 7. 6-Dialogue Sample. Knowledge Test means and standard deviations for SCAT and NO-SCAT groups.

	N	1976 Pretest		1977 Pretest		1977 Posttest	
		Mean	SD	Mean	SD	Mean	SD
SCAT	176	13	4.1	17	4.4	18	5.2
NO-SCAT	109	12	4.0	16	4.0	16	5.8

Exposure to the second 3 of 6 SCAT dialogues also resulted in statistically significant differences in Knowledge Test scores between the SCAT and NO-SCAT groups. Taking into account Knowledge Test scores at the beginning of exposure to the second 3 dialogues (1977 pretest), SCAT groups still scored higher than NO-SCAT groups at the 1977 posttest (refer back to Table 7). Again these results obtained for all groups, regardless of sex, race or grade.

Long-term effects of exposure to the first 3 SCAT dialogues were examined for the 6-dialogue sample by comparing the 1977 pretest scores while controlling for the 1976 pretest scores. Results of these analyses varied by sex and race as shown in Table 8.

Table 8. 6-Dialogue Sample. Knowledge Test means and standard deviations for SCAT and NO-SCAT groups by sex and race.

	N	1976 Pretest		1977 Pretest*	
		Mean	SD	Mean	SD
Male Whites					
SCAT	65	14	4.0	19	4.7
NO-SCAT	22	12	4.4	17	3.9
Male Minorities					
SCAT	29	10	4.8	17	3.3
NO-SCAT	13	12	3.6	15	4.6
Female Whites					
SCAT	62	12	3.5	17	3.6
NO-SCAT	53	12	3.7	16	4.0
Female Minorities					
SCAT	20	12	2.9	15	5.2
NO-SCAT	21	11	4.7	16	3.3

* Adjusted means for male white SCAT and NO-SCAT equaled 18; for female white NO-SCAT equaled 17.

The largest long-term Knowledge Test score difference between SCAT and NO-SCAT groups was for male minorities where SCAT students scored significantly higher than NO-SCAT students. Female NO-SCAT minorities scored higher than female SCAT minorities. Male and female whites in the SCAT and NO-SCAT groups scored about the same.

3-dialogue samples. Overall, exposure to 3 SCAT dialogues had a significant impact on Knowledge Test scores with SCAT groups scoring higher on their respective posttests than NO-SCAT groups (Table 9).

Table 9. 3-Dialogue Samples. Knowledge Test means and standard deviations for SCAT and NO-SCAT groups.

		Pretest		Posttest	
	N	Mean	SD	Mean	SD
1976					
SCAT	345	12	4.4	14	4.5
NO-SCAT	294	12	4.5	12	4.8
1977					
SCAT	192	15	4.3	17*	4.8
NO-SCAT	253	13	5.2	13	6.4

* Adjusted mean for 1977 SCAT equaled 16.

These SCAT/NO-SCAT differences for the 3 dialogue samples, however, must be interpreted in light of significant SCAT/NO-SCAT by grade by race interactions as summaraized in Table 10.

Table 10. 3-Dialogue Samples. Direction of higher Knowledge adjusted posttest means by treatment, grade and race.

	Treatment with Higher Mean	
	1976 Sample	1977 Sample
4th Grade		
Whites	SCAT	SCAT
Minorities	SCAT slightly	SCAT
5th Grade		
Whites	SCAT	SCAT
Minorities	SCAT	SCAT slightly
6th Grade		
Whites	____	SCAT
Minorities	SCAT	NO-SCAT

In both 4th grade samples, white SCAT students scored significantly higher than white NO-SCAT students. Minority 4th graders revealed SCAT students scoring higher than NO-SCAT for the 1977 sample but only slightly higher for 1976 sample. Similar results obtained for the 5th grade: both 1976 and 1977 white SCAT groups scored significantly higher than white NO-SCAT groups; minority SCAT students scored significantly higher than NO-SCAT students in the 1976 sample but only slightly higher in the 1977 sample. The 6th grade SCAT and NO-SCAT white students scored about the same in 1976; the SCAT group higher in 1977. For 6th grade minorities in 1976, the SCAT group scored significantly higher than the NO-SCAT group; but in 1977, NO-SCAT minorities scored higher than the SCAT minorities.

Findings concerning the impact of SCAT on Knowledge Test scores are summarized in Table 11.

Table 11. Summary of SCAT or NO-SCAT groups with the higher Knowledge Test mean scores

Sample	Group(s) with Higher Mean
1976-77 6-dialogue	
Complete program (6 of the 8 dialogues)	SCAT -- all groups
Last 3 of 8 dialogues	SCAT -- all groups
Long-term impact of first 3 dialogues	SCAT -- male minority NO-SCAT -- female minority
1976 3-dialogue	
First 3 of 8 dialogues	SCAT -- 4th grade white 5th grade white 5th grade minority 6th grade minority
1977 3-dialogue	
First 3 of 8 dialogues	SCAT -- 4th grade white 4th grade minority 5th grade white 6th grade white NO-SCAT -- 6th grade minority

SCAT produced significant effects on the Knowledge Test scores of those enrolled in the full program (6-dialogues) compared to those who had no exposure to the SCAT dialogues. This effect was found for males, females, minorities, whites and for 4th and 5th graders alike. Identical findings were revealed upon examination of the impact of the last 3 dialogues after exposure to 3 dialogues the previous year. The long-term analyses of the first 3 dialogues revealed less impact, with SCAT male minorities and NO-SCAT female minorities scoring higher while SCAT and NO-SCAT whites scored about the same.

Exposure to 3 of the 8 dialogues generally resulted in SCAT groups having higher Knowledge Test scores than NO-SCAT groups. These results did vary in intensity, however, by grade and by race. In four of the six race/grade groups in 1977, the SCAT students scored higher than NO-SCAT; in one group (6th grade minorities), the NO-SCAT group scored higher. In the 1976 sample, four of the six groups revealed SCAT scoring higher than NO-SCAT.

Findings Related to White/Minority and Male/Female Knowledge Gap

Evidence of a knowledge "gap" between minorities and whites and between males and females was found for the 1976-77 6-dialogue sample. The "gap" was operationally defined as statistically significant differences (t-tests) between minorities and whites and between males and females. The 6-dialogue sample was used to monitor the white/minority and male/female gap for the duration of the study to determine whether or not SCAT had an impact on the magnitude of this gap.

Table 12 presents mean Knowledge Test scores at time of the 1976 pretest. As shown, gap results for the total sample differ by grade. In the 4th grade, females and minorities scored only slightly lower than males and whites. In the 5th grade, there were no male/female differences in Knowledge Test scores but minorities scored significantly lower than whites.

When SCAT and NO-SCAT groups were examined separately, the gap existed only for the SCAT groups. SCAT minorities scored significantly lower than SCAT whites ($p \leq .01$); whereas SCAT females scored only somewhat lower than SCAT males ($p \leq .10$). No significant differences were found between minorities and whites or between males and females for the total NO-SCAT groups. A separate look at the 4th grade showed SCAT females and minorities scoring somewhat lower than SCAT males and whites; no differences were found for the NO-SCAT 4th graders. In the 5th grade, SCAT and NO-SCAT females scored somewhat lower than the males; SCAT minorities scored significantly lower than whites but NO-SCAT minorities and whites scored about the same.

This evidence suggested that particularly for SCAT minorities versus whites, the gap may increase as the years go by. Regardless of whether or not the gap increases over time, if left unchecked the gap would be expected at best to remain -- thus contributing to the problem of small numbers of minorities and females entering science careers. The SCAT program, as an intervention strategy, sought to affect the "knowledge gap" between males and females, whites and minorities by insuring that all groups were exposed to identical, unbiased facts about science careers.

Hypothesis

It was hypothesized that the knowledge gap between males and females and between whites and minorities is more likely to be decreased for students who are exposed to the SCAT dialogues than for those who are not exposed to the SCAT dialogues.

Table 12 . 6-Dialogue Sample. 1976 pretest Knowledge Test scores for the SCAT, NO-SCAT and total groups by sex, race and grade

	SCAT						Total		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Grade 4									
Males	40	12	3.9	18	11	3.7	58	12	3.9
Females	43	11	2.7	32	11	3.1	75	11	2.8
Whites	58	12	3.2	33	11	3.3	91	12	3.2
Minorities	25	11	3.7	17	11	3.3	42	11	3.5
Grade 5									
Males	54	14	4.9	17	13	4.4	71	13	4.8
Females	39	13	3.5	42	12	4.5	81	13	4.1
Whites	69	14]*	4.0	42	12	4.3	111	14]**	4.2
Minorities	24	11]	4.6	17	12	5.1	41	12]	4.8
Total									
Males	94	13	4.5	35	12	4.1	129	13]**	4.4
Females	82	12	3.4	74	12	4.0	156	12]	3.7
Whites	127	14]*	3.9	75	12	3.9	202	13]**	3.9
Minorities	49	11]	4.1	34	11	4.3	83	11]	4.2

$*p \leq .05$; $**p \leq .01$ level of significance of t-tests for means within brackets

Key Variables

'76 pre to '77 posttest Knowledge Growth scores -- Score 1

'76 pre to '77 pretest Knowledge Growth scores -- Score 2

'76 pre to '76 posttest Knowledge Growth scores -- Score 3

Sample

1976-77 6-dialogue sample

Analyses

The hypothesis was tested using an analysis of variance model with the three Knowledge Growth scores serving separately as dependent variables. The analyses of variance provided a comparison of growth in Knowledge scores in a direct response to the question of whether or not SCAT was affecting the gap. If growth scores were higher for females than males and/or for minorities than whites, then it is likely that the gap is being closed; on the other hand, if growth scores were lower for females and minorities, then the gap is continuing to be widened. Appendix D presents output from these analyses. Tables include Knowledge Growth score means and standard deviations by SCAT/NO-SCAT by grade by sex and by race.

Findings

Table 13 summarizes the overall treatment (SCAT versus NO-SCAT) effects for the three Growth scores.

Table 13. 6-Dialogue Sample. Knowledge Growth Score means and standard deviations for SCAT and NO-SCAT groups

		'76 Pre to '77 Posttest Growth Score 1		'76 Pre to '77 Pretest Growth Score 2		'76 Pre to '76 Posttest Growth Score 3	
	N	Mean	SD	Mean	SD	Mean	SD
SCAT	176	5.7 **	4.8	4.9	3.9	1.8 **	3.6
NO-SCAT	109	3.8	5.6	4.6	3.9	- .1	3.5

** $p \leq .01$

Growth Scores 1 and 3 were significantly higher for SCAT than for NO-SCAT groups. Growth Score 1 resulted from exposure to 6 dialogues for SCAT and showed SCAT groups gaining more than NO-SCAT groups. Since the time interval was almost a year (from the 4th to the 5th grade), NO-SCAT groups also showed a gain in Knowledge Test scores. Growth Score 3 was a measure of growth in Knowledge from exposure to only 3 SCAT dialogues with only a few weeks time between pre and posttests. As a result, SCAT groups revealed a gain in Knowledge Test scores compared with no gain for the NO-SCAT group.

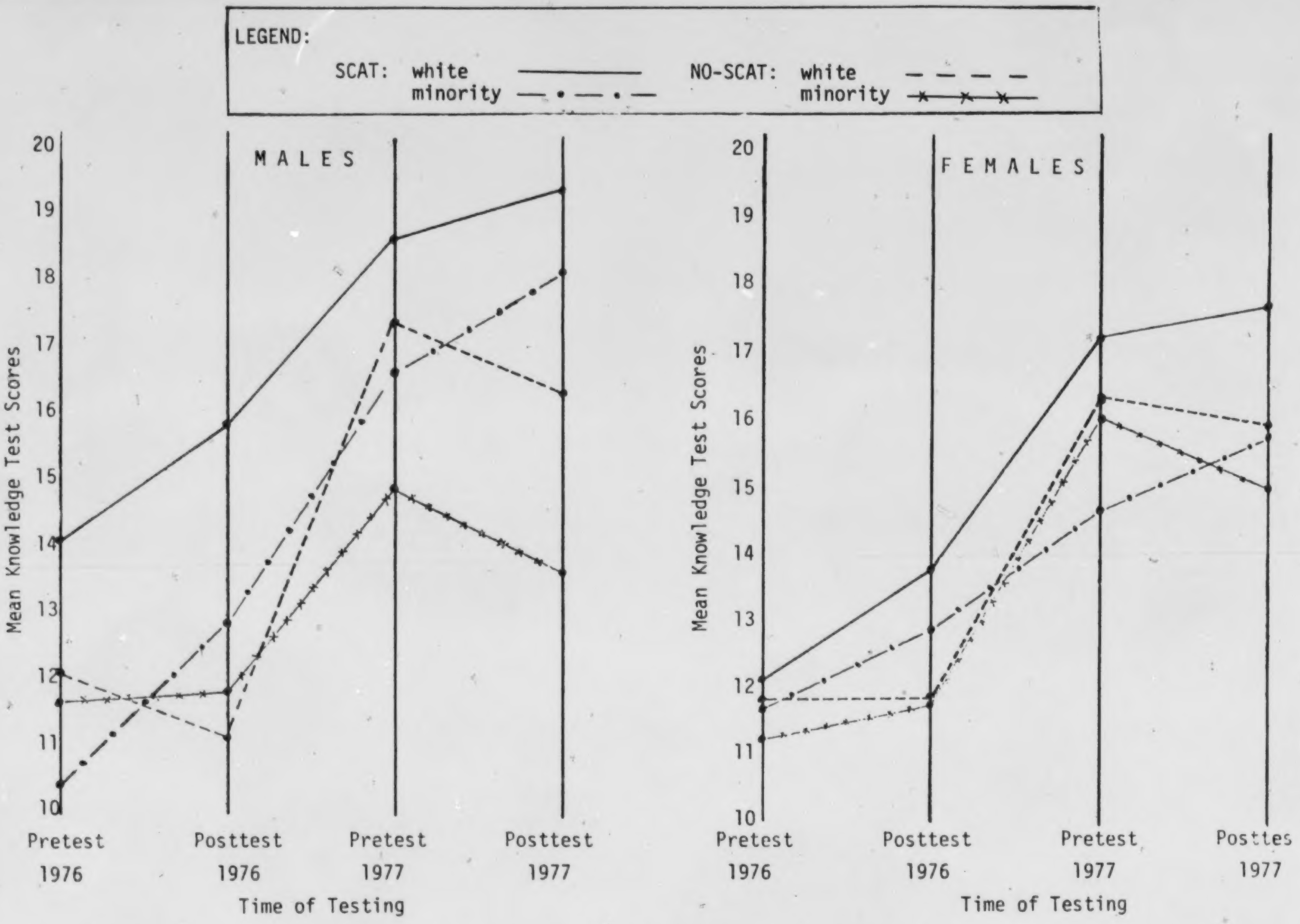
Growth Score 2, with the posttest obtained the school year following exposure to 3 SCAT dialogues, revealed no overall treatment effect. Both SCAT and NO-SCAT groups revealed gains in their Knowledge Test scores suggesting that maturation effects were more powerful than SCAT effects.

The results presented above for the Growth Scores 1 and 2 must be interpreted in light of significant three-way interactions of SCAT/NO-SCAT, sex and race. As stated above, groups with exposure to 6 SCAT dialogues (Score 1) had overall higher growth scores than NO-SCAT groups but these differences were larger for some groups than others as illustrated in Figures 2 and 3.

The largest growth scores from 1976 to 1977 posttest were for male minorities where SCAT students made large gains in Knowledge Test scores compared with NO-SCAT students. Figure 2 shows a 3.6 point difference between SCAT male minorities and SCAT male whites at the pretest; a 1.3 point difference after exposure to SCAT. This suggests that such exposure can aid in closing the knowledge gap. For the NO-SCAT male group, only a .4 point difference existed at time of pretest but at time of 1977 posttest the minorities had grown less than the whites leaving an increased gap of 2.8 point difference in favor of male whites.

Different results obtained for the female students as illustrated in Figure 3. At pretest the SCAT female whites and minorities were about the same (a .3 point difference), but at the end of exposure to 6-dialogues the gap had increased with SCAT female whites scoring 2.0 points higher than SCAT female minorities. For the NO-SCAT group at time of pretest there was a negligible difference in favor of whites; at the time of posttest one year later, the gap had increased only slightly to a .9 point difference in favor of whites. Overall, SCAT females increased their knowledge more than NO-SCAT females. However, growth was more apparent for SCAT female whites. Perhaps, these students were freer to apply themselves by acquiring knowledge; on the contrary, the female minorities had two cultural biases to overcome: that science is for males and that science is for whites.

Retention of knowledge gained from exposure to 3 SCAT dialogues tested one year later also revealed different growth rates in Knowledge Test scores for different race, sex and SCAT/NO-SCAT groups. The reader may find it useful to refer again to Figures 2 and 3 which illustrate growth patterns. As with the previous analysis of exposure to 6 SCAT



Figures 2 & 3. Mean Knowledge Test scores at four points in time for SCAT and NO-SCAT groups by race and sex.

dialogues, analyses of long-term retention of exposure to the first 3 SCAT dialogues showed SCAT male minorities making the largest gains compared to NO-SCAT male minorities. At time of the 1976 pretest there existed a 3.6 point gap between SCAT male whites and minorities in favor of male whites; at time of the 1977 pretest, this gap had been narrowed to a 2.0 point difference. The male NO-SCAT whites and minorities scored about the same on the 1976 pretest; at 1977 pretest these groups were 2.6 points apart with minorities lower than whites. These results suggest an increasing gap between male NO-SCAT whites and minorities as compared with a decreasing gap for male SCAT whites and minorities. The gap differences were mostly due to the large growth by the male minority group. In fact, for male whites, the NO-SCAT group gained slightly more.

Female groups showed mixed results of long-term retention after 3-dialogues. SCAT white and minority females who were about equal at time of 1976 pretest showed a 2.6 point gap in favor of whites at time of the 1977 pretest. This was the result of female whites growing more than female minorities. For the NO-SCAT females a 1976 pretest difference of only .5 point increased slightly to a .9 point difference. In this case both groups grew about the same. Overall, these comparisons found large differences in growth between SCAT and NO-SCAT male minorities and smaller differences for female whites, both in favor of SCAT; male white and female minority growth, however, was slightly larger for the NO-SCAT groups.

As shown in Table 14, growth in Knowledge Test scores for the SCAT and NO-SCAT groups differed according to the points in time at which the testing occurred.

Table 14. 6-Dialogue Sample. Summary of SCAT and NO-SCAT groups with the highest Knowledge mean growth scores.

Score	Group(s) With Highest Growth Scores
'76 Pre to '77 Posttest Growth Score 1	SCAT -- all groups
'76 Pre to '77 Pretest Growth Score 2	SCAT -- Male minorities Female whites (slightly higher)
'76 Pre to '76 Posttest Growth Score 3	SCAT -- Male minorities Female whites (slightly higher)

Overall, all SCAT groups after exposure to 6 dialogues grew significantly more than NO-SCAT groups. After exposure to 3 dialogues, SCAT male minorities grew considerably more and female whites grew slightly more than their counterpart NO-SCAT groups. Likewise, long-term effects of 3 dialogues showed that SCAT male minorities grew considerably more and that female whites grew slightly more than their NO-SCAT counterparts.

Findings Related to Interest in Science as a Career

Given that intervention strategies can be designed to increase students' knowledge about science careers, there still remain implied motivational differences between males and females, whites and minorities which influence the selection of science as a career. Cultural biases that science careers are not for females or minorities must be countered if more females and minorities are to become scientists. One such counterattack is to motivate or interest females and minorities in science careers. In fact, to overcome such huge obstacles, it may be necessary to increase interest in females and minorities much more than in males and whites in order to balance the equation.

All SCAT students were presented identical dialogues and related photographs of scientists at work. The photographs were carefully selected to insure that role models were presented for all students, regardless of race or sex. Thus, SCAT students saw pictures of white males and females as well as minority males and females at work as scientists. By presenting role models to females and minorities, in particular, it was hoped that these students would experience an increasing awareness that science careers are indeed open to them and thus their interest in science would be encouraged.

Hypothesis

It was hypothesized that students who are exposed to SCAT dialogues are more likely to express interest in science as a career than those who are not exposed to SCAT dialogues.

Key Variables

Science Career Interest

General Science Interest

Interest in SCAT Careers

Science Career Choice

Samples

1976-77 6-dialogue sample

1976 3-dialogue sample

1977 3-dialogue sample

Analyses

Two types of analyses were used to test the hypothesis. The first three scores (Science Career Interest, General Science Interest and Interest in SCAT Careers) were examined using an analysis of covariance model. The model statistically controlled for initial differences in interest by using 1977 pretest scores as the covariate and the 1977 posttest scores as the dependent variable. These analyses of covariance were conducted for the 1976-77 6-dialogue sample and the 1977 3-dialogue sample.

The second type of analyses were chi-square analyses of Science Career Choice responses. Contingency tables compared pre/post responses on selection of science or nonscience careers for SCAT and NO-SCAT groups.

Appendix E presents output from these analyses. Tables include interest pretest and posttest means and standard deviations by SCAT/NO-SCAT by grade by sex and by race. Adjusted means for SCAT/NO-SCAT, grade, sex and race are also presented.

Findings

The analyses of covariance revealed similar results for the first three interest scores: Science Career Interest, General Science Interest, and Interest in SCAT Careers. As shown in Table 15, SCAT students in the 1977 3-dialogue sample scored significantly higher than NO-SCAT students; SCAT and NO-SCAT students in the 1976-77 6-dialogue samples revealed no significant differences. This may suggest that the major increase in interest occurs from the initial exposure to the first three SCAT dialogues but that this interest does not increase proportionately from exposure to an additional 3 dialogues after the initial exposure.

In the case of the Interest in SCAT Careers score, the SCAT effect for the 1977 3-dialogue sample must be interpreted in light of a significant SCAT/NO-SCAT by grade by sex interaction. Figures 4 and 5 are diagrams of pre and posttest means for SCAT and NO-SCAT males and females by grade. For the male group, SCAT fourth graders scored higher than NO-SCAT fourth graders. This resulted from SCAT students scoring slightly higher at time of posttest than at time of pretest while NO-SCAT students scored lower at time of posttest than at time of pretest. Male SCAT and NO-SCAT 5th graders scored about the same on posttest; on the pretest, SCAT male 5th graders scored higher than NO-SCAT 5th grade males. Sixth grade SCAT and NO-SCAT students revealed a pattern similar to the fourth graders with SCAT gaining slightly from pre to posttest while NO-SCAT lost.

Female students revealed different Interest in SCAT Careers score patterns than males. Fourth grade SCAT females scored higher on the posttest than NO-SCAT females. This was the result of SCAT student interest scores remaining about the same from pre to posttest while NO-SCAT interest scores dropped substantially. Fifth grade SCAT females also scored higher on the posttest than NO-SCAT females. These fifth grade differences were the result of a large increase in interest for SCAT female students and a large decrease for NO-SCAT female students. Unlike the male group, 6th grade SCAT and NO-SCAT females scored about the same on the pretest as on the posttest; in both testings the NO-SCAT scores were somewhat lower than the SCAT scores.

Table 15. Science interest score means and standard deviations for the 1977 3-dialogue sample and the 1976-77 6-dialogue sample

	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Adjusted Mean
1977 3-Dialogue Sample						
Science Career Interest*						
SCAT	192	5.3	2.6	5.7	2.4	5.5
NO-SCAT	253	5.0	2.3	4.8	2.8	4.9
General Science Interest*						
SCAT	192	16.6	4.9	17.3	5.9	16.8
NO-SCAT	253	15.6	5.5	14.9	6.9	15.2
Interest in SCAT Careers*						
SCAT	192	5.6	3.2	5.7	3.4	5.6
NO-SCAT	253	5.3	3.5	4.4	4.7	4.5
1976-77 6-Dialoque Sample						
Science Career Interest						
SCAT	176	5.5	2.4	5.5	2.5	5.4
NO-SCAT	109	5.4	2.4	5.2	2.9	5.2
General Science Interest						
SCAT	176	17.1	5.7	17.1	6.2	16.8
NO-SCAT	109	16.1	4.9	15.5	6.1	16.1
Interest in SCAT Careers						
SCAT	176	6.5	3.0	5.3	3.5	4.9
NO-SCAT	109	5.0	3.5	4.6	3.5	5.1

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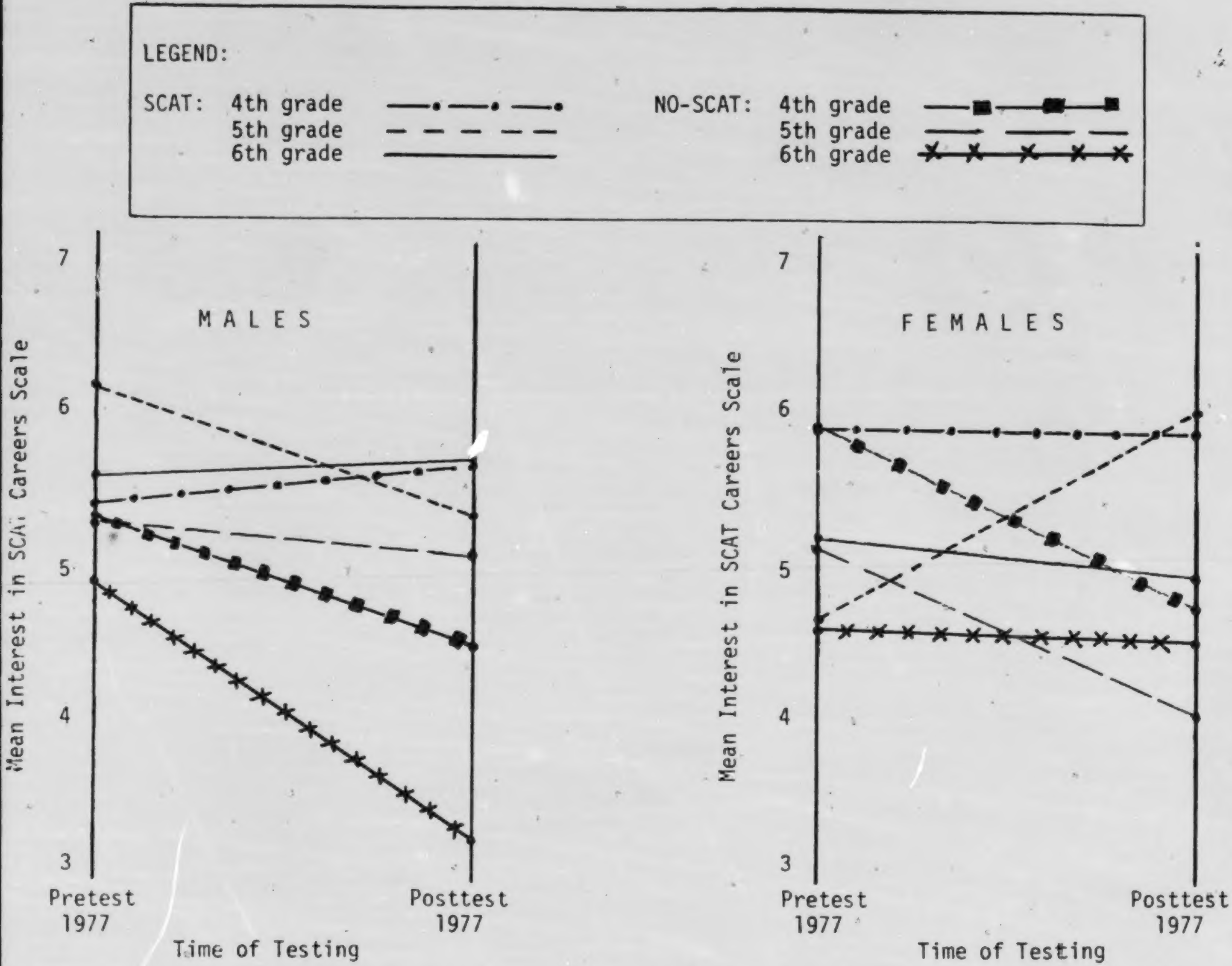
* Significant SCAT effect at $p \leq .05$



Figures 4 & 5. Mean Interest in SCAT Careers Score at 1977 pre and posttests for SCAT and NO-SCAT groups by sex and grade.

Table 16 summarizes the results of the analyses of covariance on the three interest scores.

Table 16. Summary of groups with highest interest mean scores for the 1977 3-dialogue and the 1976-77 6-dialogue samples

	Science Career Interest	General Science Interest	Interest in SCAT Careers
1977 3-Dialogue Sample	SCAT	SCAT	SCAT 4th Grade Males 4th Grade Females 5th Grade Females 6th Grade Males
1976-77 6-Dialogue Sample	--	--	--

SCAT/NO-SCAT differences were not found to be significant for the 1976-77 6-dialogue sample . For the 1977 3-dialogue sample the SCAT students scored significantly higher than NO-SCAT students for all three interest scores. For the Interest in SCAT Careers scores, SCAT 4th grade males and females, SCAT 5th grade females, and SCAT 6th grade males scored higher.

Chi-square analyses of Science Career Choice failed to reveal any significant SCAT and NO-SCAT differences as far as selecting science as a career.

Findings Related to Career Maturity

Underlying the research goals and approach was the assumption that elementary school students are in a dynamic stage of their lives where maturation occurs quite naturally and quite dramatically. It was precisely because of this assumption that elementary school students were selected as the target population for this research. Career decision-making was seen as a process which starts very early in life -- often when a child lacks the information needed to make such decisions -- and which changes as the student matures. Thus, it happens that very early the career options available to a student begin to become limited at a time when the student is vulnerable to misinformation and, as importantly, to cultural stereotypes as to what is and what is not an appropriate career. The Science Career Awareness Training program, therefore, attempted to aid students in the process of career decision-making by presenting them with accurate, unbiased information about some careers which they might have already eliminated or might have never considered as options for themselves.

Hypothesis

It was hypothesized that students who are exposed to SCAT dialogues will be able to make decisions about science careers in a more mature way than those who are not exposed to SCAT.

Key Variable

Career Maturity Inventory--Attitude Scale

Sample

1976-77 6-dialogue Sample

Analyses

Analysis of covariance models examined differences in Career Maturity Attitude (CMI-Attitude) scores for SCAT and NO-SCAT groups by sex, by race and by grade. The dependent variable was the 1977 posttest score; the covariate, the 1976 pretest score. These analyses were conducted for the 1976-77 6-dialogue sample only, since it was assumed that growth in career maturity would manifest itself only over a reasonable length of time.

Appendix G presents output from these analyses of covariance. Tables include CMI-Attitude pretest and posttest means and standard deviations by SCAT/NO-SCAT by sex by race and by grade. Adjusted means for SCAT/NO-SCAT, grade, sex and race are also presented.

Findings

The analyses revealed significant differences between SCAT and NO-SCAT groups with NO-SCAT having higher CMI-Attitude scores. Table 17 presents the mean CMI scores for these two groups.

Table 17. 1976-77 6-Dialogue Sample. CMI-Attitude Scale means and standard deviations for SCAT and NO-SCAT.

		1976 Pretest		1977 Posttest	
	N	Mean	SD	Mean	SD
SCAT	176	27	5.4	29	7.3
NO-SCAT	109	26	5.9	31	8.8

The NO-SCAT scores were consistently higher than SCAT scores for males, for females, for whites and for minorities. No significant interactions of SCAT/NO-SCAT by race, by sex or by grade were found.

Findings Related to Realism of Science Career Choices

One of the main problems in choosing an occupation is unrealism. Many students tend to choose "attractive" careers about which they know very little or for which they do not have the necessary skills. Since a major goal of this research was to better inform students regarding science careers and the kinds of work scientists do, it was expected that those students who chose science careers would do so on a better informed and perhaps a more realistic basis. Thus, one of the questions in evaluating the SCAT program concerned realism of career choice and how SCAT and NO-SCAT students compared on this dimension. For purposes of this study, realistic career choices were operationally defined as follows:

- students with high knowledge or high math competency scores being more likely to select science careers; and

- students with low knowledge or low math competency scores being less likely to select science careers.

Hypothesis

It was hypothesized that students who are exposed to SCAT dialogues are more likely to make realistic career choices than those who are not exposed to SCAT dialogues.

Key Variables

Science Career Choice

Knowledge of Science Careers

Iowa Test of Basic Skills

Sample

1976-77 6-dialogue Sample

Analyses

Chi-square analyses were conducted which compared SCAT and NO-SCAT students' science/nonscience career choice controlling separately for level (high versus low) of knowledge and level of math competency. High scores were defined as those that were one or more standard deviation units above the combined SCAT and NO-SCAT group mean. Low scores were defined as those that were one or more standard deviation units below the combined SCAT and NO-SCAT group mean.

Findings

The chi-square analyses revealed no significant differences between SCAT and NO-SCAT students in career choice. This was true when controlling separately for high and low level of knowledge and when controlling separately for level of math competency. There were no significant differences between SCAT and NO-SCAT students on the basis of realism of career choice. Appendix H presents the percentages of high and low scorers for SCAT and NO-SCAT who chose science-related careers. On the pretest 76, the percentages of high scorers who chose science careers ranged from 32% to 54% for SCAT and 44% to 54% for NO-SCAT. Low scorers who chose science careers ranged from 12% to 36% for SCAT and 18% to 36% for NO-SCAT. On the posttest 77, the percentages of high scorers who chose science careers ranged from 38% to 58% for SCAT and 55% to 70% for NO-SCAT. Low scorers who chose science careers ranged from 32% to 58% for SCAT and 39% to 50% for NO-SCAT.

Findings Related to Stereotypical Career Choices

It is a well known fact that women and minorities are underrepresented in science careers. Even at the high school level, fewer female and minority students tend to have career aspirations which are science-related. On the other hand, those who do choose science tend to shy away from areas such as mathematics and physics. Obviously, certain cultural biases and stereotypes are operating which have the effect of steering females and minorities away from certain careers. In addition to providing information about the kinds of work scientists do, another goal of SCAT was to show students that women and minorities can and do become all kinds of scientists. It was expected, therefore, that following exposure to SCAT dialogues these cultural biases would operate to a lesser degree.

Hypothesis

It was hypothesized that students who are exposed to SCAT dialogues are less likely to select a career according to cultural career stereotypes than those who are not exposed to SCAT dialogues.

Key Variables

Science Career Choice

Interest in SCAT Careers

Samples

1976 3-dialogue Sample

1977 3-dialogue Sample

Analyses

Several analyses were used to first identify pretest stereotyped career choices and then to examine SCAT and NO-SCAT responses. Frequency counts were used to determine the numbers of males, females, whites and minorities choosing science careers on the pretest. Chi-squares based on combined SCAT and NO-SCAT pretest data compared males with females and whites with minorities on Interest in SCAT Careers. Finally, chi-squares compared males with females and whites with minorities on Interest in SCAT Careers separately for SCAT and NO-SCAT pretest and posttest.

Findings

Pretest Results. Table 18 presents the data compiled from the frequency pretest counts. It lists the different science career categories with the numbers and percentages of career choices for males, females, whites, minorities and the total sample. Of the total number of careers chosen, the percentages that were science or science-related were 40.3% for females; 34.3% for males; 38.8% for whites and 34.6% for minorities with 37.5% for the total sample.

Health Science had the largest percentage of career choices with females and minorities choosing Health Science careers more often than males and whites, respectively. In Physics, the trend was reversed: the percentage of males choosing a career in Physics was much higher than that of females and the percentage of whites higher than that of minorities. The percentage of males choosing Engineering was over three times that for females, and minorities chose Engineering twice as often as did whites. For both Biological Science and Social Science, the percentages of choices for whites were greater than those for minorities, with only small differences between males and females. In Chemistry, Earth Science, and Mathematics the small number of career choices made it difficult to determine any substantial race or sex differences.

A further breakdown of science career choices appears in Appendix F where each science category is divided into even finer career choices, allowing a more detailed look at trends in career choice. The Health Sciences show some interesting examples of career stereotypes. While a large percentage of females chose Nurse, an even larger percentage chose Doctor. The percentage of females choosing Doctor, however, was much smaller than that for males. The same relationship held for minorities and whites, with the percentage of minorities choosing Doctor greater than that for whites. More males and more whites tended to choose Dentist than did females and minorities. The career choice of Veterinarian had almost equal percentages for male and female, while whites chose this career more often than minorities. In the Biological Sciences, the most popular choice for each student category was Biologist. Almost equal percentages of males and females chose Zoologist, yet no minority students chose this career. In Physics, Space Scientist accounted for at least 75% of the choices for each student category. Engineering was broken down into two careers: Engineer and Architect. Architect accounted for over 85% of the female choices while choices for males, whites and minorities were about equally distributed between Architect and Engineer.

Results of the pretest chi-square analyses using SCAT plus NO-SCAT groups combined appear in Table 19. The table indicates significant sex and race differences on Interest in SCAT Careers. Eight scientists are listed and the sex/race category of students favoring a particular scientist is indicated (by grade).

Table 18. Numbers and percentages of students in grades 4, 5 and 6 choosing science careers

	Total			Female			Male			White			Minority		
	N	%*	%**	N	%*	%**	N	%*	%**	N	%*	%**	N	%*	%**
Biological Science	30	2.8	7.4	19	3.3	8.1	11	2.2	6.3	27	3.5	9.1	3	.9	2.7
Chemistry	10	.9	2.5	3	.5	1.3	7	1.4	4.0	9	1.2	4.0	1	.3	.9
Earth Science	9	.8	2.2	2	.3	0.8	7	1.4	4.0	7	.9	2.3	2	.6	.9
Engineering	26	2.4	6.4	7	1.2	3.0	19	3.7	10.9	15	2.0	5.0	11	3.5	10.0
Health Science	247	22.7	60.5	178	30.7	76.1	69	13.6	39.7	174	22.6	58.4	73	23.0	66.4
Mathematics	9	.8	2.2	4	.7	1.7	5	1.0	2.9	5	.7	1.7	4	1.3	3.6
Physics	35	3.2	8.6	4	.7	1.7	31	6.1	17.8	29	3.8	9.7	6	1.9	5.5
Social Science	16	1.5	3.9	9	1.6	3.8	7	1.4	4.0	15	2.0	5.0	1	.3	0.9
Other	26	2.4	6.4	8	1.4	3.4	18	3.6	10.3	17	2.2	5.7	9	2.8	8.2
Total	408	37.5	100.0	234	40.3	100.0	174	34.3	100.0	298	38.8	100.0	110	34.6	100.0

* percentages based on total number of career choices
** percentages based on total number of science career choices

Table 19. 1977 3-Dialogue Sample. Sex and race differences on pretest Interest in SCAT Careers for SCAT plus NO-SCAT groups

	Grade 4	Grade 5	Grade 6	Grades 4+5+6
Biologist	-	Minority**	-	-
Chemist	Male**	-	-	-
Earth Scientist	-	-	-	Minority**
Engineer	Male**	Male** Minority*	Male**	Male**
Health Scientist	Female** Minority**	Female* Minority**	Female* Minority**	Female** Minority**
Mathematician	Female** Minority*	-	-	Female* Minority**
Physicist	-	-	-	-
Social Scientist	-	Minority**	Female*	Minority**

$^{**}p \leq .05$; $^{*}p \leq .10$

- Sex differences. For Chemist, a significantly larger percentage of 4th grade males than females responded positively. For grades 5 and 6 and grades 4, 5, and 6 combined, there were no significant sex differences in favorableness towards Chemist. Males responded more favorably to Engineer. This was true for each of the three grades separately and for all three grades combined. The reverse held true for Health Scientist with females responding more favorably across all grade categories. For Mathematician, more females responded positively when comparing male and female 4th graders and again when all three grades were combined.

No sex differences were found for grades 5 and 6. More females than males responded positively to Social Scientist, but only at the sixth grade level. No significant sex differences were found for Biologist, Earth Scientist or Physicist.

- Race Differences. As can be seen in Table 19, in all instances the percentage of minorities responding positively to a scientist was greater than that of whites. For Biologist and Engineer, 5th grade minorities tended to favor these scientists more than whites, with no significant race difference in grades 4 and 6 or in the combined grades. For Earth Scientist and Physicist, no differences appeared for the separate grades; however, in combining the three grade levels, more minorities than whites tended to favor these two careers. A significant difference was found between whites and minorities across all grade categories for Health Scientist. For Mathematician more minorities than whites favored this career in grades 4 and 6 and in grades 4, 5, and 6 combined. Minorities tended to respond more positively to Social Scientist in grade 5 and in grades 4, 5, and 6 combined. No significant race differences were found for Chemist.

Comparison of pretest and posttest responses. Results of the pretest and posttest chi-squares for grades 4, 5, and 6 combined conducted separately for SCAT and NO-SCAT appear in Table 20. The table lists eight scientists and the sex/race category of student favoring a particular scientist is indicated wherever significant chi-squares were found.

Table 20. 1977 3-Dialogue Sample. Sex and race differences on Interest in SCAT Careers for SCAT/NO SCAT pretest and posttest

		Pretest		Posttest	
		Sex	Race	Sex	Race
Biologist	SCAT	Female*	-	-	-
	NO-SCAT	-	Minority*	-	-
Chemist	SCAT	-	White**	-	-
	NO-SCAT	-	-	-	-
Earth Scientist	SCAT	-	-	-	-
	NO-SCAT	-	Minority**	-	-
Engineer	SCAT	Male*	-	Male*	-
	NO-SCAT	Male**	-	Male**	-
Health Scientist	SCAT	Female**	Minority*	Female**	-
	NO-SCAT	Female**	Minority**	Female**	-
Mathematician	SCAT	-	-	Female*	-
	NO-SCAT	Female**	Minority**	Female**	Minority**
Physicist	SCAT	-	-	-	-
	NO-SCAT	-	Minority**	Female**	Minority**
Social Scientist	SCAT	-	-	-	-
	NO-SCAT	-	Minority**	-	-

*p≤.10 ; **p≤.05

- Sex differences. For Biologist, females on the pretest responded more favorably than males in the SCAT group; on the posttest there were no sex differences for either SCAT or NO-SCAT. For Chemist, Earth Scientist and Social Scientist, no sex differences were present on the pre or posttest. Males in SCAT and NO-SCAT groups responded more favorably to Engineer on the pretest and posttest, while females responded more favorably to Health Scientist. For Mathematician, NO-SCAT females responded more favorably than males on the pretest; on the posttest, both SCAT and NO-SCAT females responded more favorably than males. No sex differences were found for Physicist on the pretest; however, posttest responses were in favor of females for the NO-SCAT group.

- Race differences. For Biologist, Earth Scientist, Mathematician, Physicist and Social Scientist, NO-SCAT minorities responded more favorably than whites on the pretest, with no race difference for SCAT. By the time of posttest, race differences favoring NO-SCAT minorities remained for only two of these scientists -- Mathematician and Physicist. For Chemist, white students in SCAT responded more favorably on the pretest. For Health Scientist, both SCAT and NO-SCAT minorities responded more favorably than whites on the pretest with no race differences present on the posttest.

Findings Related to Relationships Among Dependent Variables

In addition to looking at the relationship between SCAT/NO-SCAT and knowledge about science careers and the relationship between SCAT/NO-SCAT and interest in science as a career, in terms of evaluating the impact of science career dialogues upon these and other variables we were interested in the relationships these dependent variables have with one another. The relationships were examined at four points in time: pretest 76, posttest 76, pretest 77, and posttest 77. Such an analysis allowed not only an examination of how the variables were related, but also an examination of how the relationships changed over time.

Hypothesis

It was hypothesized that the relationship between knowledge about science careers and interest in science as a career and between knowledge and career maturity is likely to increase over time as students acquire more knowledge about science careers. Also, it was hypothesized that there is a positive relationship between competency in mathematics and knowledge about science careers, interest in science as a career and career maturity.

Key Variables

Knowledge about Science Careers

Science Career Choice

Science Career Interest

Interest in SCAT Careers

Career Maturity Inventory

Iowa Test of Basic Skills (ITBS)

Sample

1976-77 6-dialogue Sample

Analyses

Pearson product-moment correlations and point-biserial correlations were obtained for pairs of variables.

Findings

Table 21 presents the correlations of knowledge about science careers and interest in science as a career and career maturity. Only one interest score, Science Career Choice, was used for this analysis. While three other interest scores were available, only the Science Career Choice scale was administered on the pretest and posttest 76, thus providing baseline data prior to initial exposure to SCAT dialogues. At the time of pretest 76, there were negative correlations between Knowledge and Science Career Choice. Of the six samples, all correlations were significant at at least the .05 level except for 5th grade NO-SCAT. On posttest 76, all correlations remained negative, with only one sample, 5th grade SCAT, having a significant correlation. On pretest 77, four of the six samples had significant positive relationships between knowledge and interest. By the time of posttest 77, all six samples had a positive correlation significant at at least the .05 level.

Table 21. 1976-77 6-Dialogue Sample. Correlations of Knowledge about Science Careers with Interest in Science as a Career and with Career Maturity

	1976		1977	
	Pretest	Posttest	Pretest	Posttest
Knowledge with Science Career Choice				
4th Grade Total	-.26**	-.13	.23**	.27**
5th Grade Total	-.23**	-.22	.20**	.30**
4th Grade SCAT	-.33**	-.19	.29**	.28**
5th Grade SCAT	-.22*	-.26**	.07	.21*
4th Grade NO-SCAT	-.15	-.01	.17	.26*
5th Grade NO-SCAT	-.25*	-.16	.38**	.33**
Knowledge with Career Maturity				
4th Grade Total	.18*	-	-	.36**
5th Grade Total	.40**	-	-	.60**
4th Grade SCAT	.25*	-	-	.37**
5th Grade SCAT	.38**	-	-	.54**
4th Grade NO-SCAT	.08	-	-	.44**
5th Grade NO-SCAT	.41**	-	-	.74**

* $p \leq .05$; ** $p \leq .01$

The correlations between knowledge and career maturity are presented for pretest 76 and posttest 77. At the time of pretest 76, all correlations were positive and significant at at least the .05 level except for the 4th grade NO-SCAT sample. By the time of posttest 77, all correlations were positive and significant at the .01 level. There was a significant increase in the magnitude of the relationship between knowledge and career maturity for two samples -- 5th grade Total and 5th grade NO-SCAT.

Correlations between math competency and knowledge about science careers, interest in science as a career and career maturity appear in Appendix I. Though only one set of ITBS math scores was available for each student (the 1976 5th grade sample took the ITBS in Spring 76 and the 1976 4th grade sample took the ITBS in Spring 1977), the scores are correlated with knowledge, interest and career maturity for four points in time. We are assuming that students maintained the same level of math competency throughout the two-year period of the SCAT program. For each of the six samples, there was a positive correlation between ITBS scores and knowledge test scores. This was true for pre-and posttest 76 and for pre-and posttest 77. Correlations between ITBS and career maturity are positive and significant at time of pretest 76 for all but the 4th grade NO-SCAT sample and again positive and significant on the posttest 77 for all samples except for 5th grade Total. There is no consistent pattern of relationship between math competency and interest in science as a career.

SUMMARY

In summary, the primary goal of this research was to evaluate the effectiveness of SCAT in providing elementary school students in the 4th, 5th and 6th grades with information about careers in science. Secondary goals were to evaluate the effect of SCAT on interest in science as a career, career maturity, realism of career choices, and cultural career stereotypes reflected in the selection and non-selection of science careers. Finally, it was of interest to examine the relationship of the factors mentioned above to each other. This section summarizes the results related to each of these goals including whether or not the research hypothesis was confirmed, for which groups it was confirmed and a brief discussion of the results.

Concerning Knowledge About Science Careers

Overall, the results confirmed the hypothesis that students who are exposed to SCAT dialogues are more likely to have greater knowledge about science careers than those who are not exposed to SCAT dialogues. This finding was more consistent across subgroups (by sex, race, and grade) for those who were exposed to the complete set of dialogues (at least 6 of the 8 dialogues) than for those who were exposed to fewer dialogues (at least 3 of the 8 dialogues). These findings indicate that indeed it is possible to affect elementary school students' knowledge about science careers through the use of a non-biased, self-paced computerized system. A computerized system such as SCAT, therefore, has the potential of reaching large numbers of students in the late elementary school grades, helping them to become more knowledgeable about science careers and thus more able to begin to make career decisions based on accurate information.

Examination of Knowledge Test scores over four time periods (pretest 1976, posttest 1976, pretest 1977, posttest 1977) revealed mixed results related to the hypothesis that the knowledge gap between males and females and between whites and minorities is more likely to be decreased for students who are exposed to the SCAT dialogues than for those who are not exposed to the SCAT dialogues. The SCAT program was effective in reducing the white/minority knowledge gap for males, by helping SCAT minority males to grow significantly more than SCAT white males; NO-SCAT minority males, on the other hand, grew further and further behind NO-SCAT white males. The SCAT program also had a significant impact on females; it did not, however, have the effect of narrowing the gap between white and minority females. This was primarily due to the large stimulation of growth for SCAT white females, actually resulting in the creation of a gap. Without the advantage of SCAT, nonetheless, the NO-SCAT minority females continued to score lower than NO-SCAT white females. These results suggest that SCAT can be quite effective in increasing knowledge scores for all groups, particularly for those which have traditionally been the object of culturally-sanctioned career stereotypes limiting their entrance into science-related careers. However, there does appear to be a need for the further development of SCAT as it relates to female minorities, the group confronted with both sex and race career stereotypes.

Concerning Interest in Science as a Career

Confirmation/non-confirmation of the hypothesis that students who are exposed to SCAT dialogues are more likely to express interest in science as a career than those who are not exposed to SCAT dialogues was a function of the type of interest measure used. In general, the hypothesis was confirmed when interest in science careers was measured by means of specific questions with limited response categories. Thus, when students were given well-defined forced-choices of science-related versus non-science-related activities or work, the SCAT students (after exposure to 3 of 8 dialogues) revealed more interest in science than the NO-SCAT students. (Similar increases in interest did not occur during exposure to the second 3 dialogues when interest after the first 3 dialogues was statistically controlled.) The hypothesis was not confirmed, however, when students were presented with the open-ended question, "what is the one thing you want to be when you grow up?" In this instance, the SCAT and NO-SCAT groups responded alike, i.e., science or science-related careers were selected with about the same frequency.

These findings may result from the fact that the open-ended measure of career choice was crude at best, allowing for a huge gamut of responses. More likely, however, the findings may merely reflect the fact that the SCAT students have only begun to have an increased interest in science as a career. Their budding interests will, therefore, need to be encouraged to grow before science career choices are as likely as other more "traditionally acceptable" career choices to make the "final selection." It may be quite unreasonable to expect such far-reaching consequences from a program that was designed as an "awareness-raising" opportunity. The results are promising, nonetheless, in that they show that SCAT is a good first step toward influencing motivations related to science career choices.

Concerning Career Maturity

The hypothesis that students who are exposed to SCAT dialogues are more likely to increase in career maturity than those who are not exposed to SCAT dialogues was definitely not confirmed. On the contrary, NO-SCAT students consistently scored significantly higher on the CMI Attitude Scale than SCAT students. Since this finding was a complete reversal of the stated hypothesis, the CMI literature was re-examined for clues to explain the findings.

Crites has stated, "the two major problems in choosing an occupation which arise in the course of career development during the high school years are indecision and unrealism." (Crites, 1973, p. 32). Carek (1965), Crites (1971) and Hollender (1964) found that the CMI Attitude Scale correlates with career unrealism and indecision. Our research, presented earlier, revealed no differences between the SCAT and NO-SCAT groups on realism of career choice when realism was defined as the percentage of students with high scores in knowledge about science careers and in math competency who selected science as a career, and likewise, the percentage of students with low scores who selected non-science as a career.

Career indecision, on the other hand, was not measured in the SCAT research. Goodson (1969) found that upon entrance into college career attitudes can become less mature (when compared with a control group) since students are experiencing a new environment with which they must learn to cope. It seems that a somewhat parallel situation was operating for the SCAT students. They were being presented a new set of alternative careers, many which they had not considered before, or had considered "out of reach" and then rejected. Thus, an increase in indecisiveness would be very natural under the circumstances. Such indecisiveness is very likely a necessary part of the career decision-making maturation process. For, at a time when most students were narrowing their career options, the SCAT students were actually widening their career options as evidenced in the three interest scores where SCAT students tended to increase their interest in science more than NO-SCAT students. These findings suggest that guidance may be an essential ingredient in a program such as SCAT. Students who find themselves in an unfamiliar situation where they are actually investigating careers which may be contrary to culturally-sanctioned ideals will necessarily have to rethink their career decisions. At this time, additional support and understanding can help these students in their self-evaluation--a process which is so vital to making realistic, satisfying career decisions.

Concerning Realism of Career Choices

The hypothesis that students who are exposed to SCAT dialogues are more likely to make realistic career choices than those who are not exposed to SCAT dialogues was not supported by the data. There were no significant differences between SCAT and NO-SCAT students on the basis of realism of career choice as defined by the percentage of students with high and low knowledge about science careers and math competency scores who selected science as a career. This suggests that exposure to SCAT dialogues is not related to realism of career choice. These results, however, should not be taken as conclusive for several reasons. First of all, career choice was based on the open-ended question, "what is the one thing you want to be when you grow up?" This measure, which was the only one available for the two-year group, was scored as a dichotomy. It did not take into account the extent to which the student intended to pursue the career, e.g., technical, professional level, etc.; other, more fully developed forced-choice interest measures were not available until the second year of the study. Secondly, the definition of realism of career choice was limited. It did not examine the students interests and capabilities other than knowledge about science careers and math competency. It is possible that findings similar to that concerning career maturity will surface; this might suggest an iterative process whereby more unrealism results from presenting new career options at least initially. The second step in the process may be to make the career choice realistic. For example, a student could initially decide to become a doctor and later modify this decision to a doctor's assistant or vice versa. For now, however, such hypotheses remain to be tested. Further exploration of this question may prove interesting in understanding the career decision-making process.

Concerning Career Stereotypes

The hypothesis that students who are exposed to SCAT dialogues are less likely to select a career according to cultural career stereotypes than those who are not exposed to SCAT dialogues was not confirmed. The analyses indicated that at the 4th, 5th and 6th grade levels, in comparing pretests and posttests for SCAT and NO-SCAT students, posttest career preferences for SCAT students continued to exhibit the same pretest stereotypic trends following exposure to the science career dialogues. There was one exception -- at the time of pretest, more minority students in the SCAT group tended to favor Health Scientist while on the posttest, no race differences were found; however, this same relationship was present for students in the NO-SCAT group. This suggests that while certain stereotypes may shift over time due to maturation or other factors, exposure to SCAT dialogues does not in itself have an immediate effect on altering cultural biases. The students employed in the pretest-posttest analysis were those who were exposed to only three science career dialogues. It is possible that a second exposure to three or more additional dialogues would produce different results.

Concerning Relationships Among the Variables

The hypothesis that relationships among the study variables would change over time with increased exposure to SCAT was not confirmed. In no case were there significant changes in relationships among variables from one testing to the next, i.e., from pretest 1976 to posttest 1976 to pretest 1977 to posttest 1977. There were, however, the following significant long-term changes in relationships, i.e., from pretest 1976 to posttest 1977.

- The correlation between knowledge about science careers and science career choice changed from a negative one at the time of pretest 1976 to a positive one by the time of posttest 1977, indicating that career decisions were later being made on the basis of more knowledge. Since the relationship was the same for both SCAT and NO-SCAT groups, this change was probably due to maturational factors.

- For the 5th grade Total sample and 5th grade NO-SCAT sample, there was an increase in the magnitude of the relationship between knowledge about scientists and career maturity. The fact that there was no similar increase for 5th grade SCAT students appears to support the notion that an increase in knowledge about science careers contributed to career indecision for SCAT students.

CONCLUSIONS

The Science Career Awareness Training (SCAT) program proved effective as a means of increasing knowledge about science careers and interest in science as a career for students in the late elementary school grades (4, 5 and 6). Thus, the SCAT program affects the knowledge and the motivation bases of career choices. Participants in the program became more indecisive as far as career choices were concerned, indicating that new alternative careers were being considered. The final career choice in response to the question "what is the one thing you want to do when you grow up?" did not reflect changes in career choice realism or stereotypes.

The SCAT program target population of late elementary school-age children in the 4th, 5th and 6th grades seemed very ready and responsive to the input of new career alternatives. Among these students, certain stereotypic career-choice behaviors were already apparent suggesting that the sooner new career choices are presented, the more likely they are to have an impact. It may be that such innovative programs should start even earlier in the 1st, 2nd or 3rd grades. In any case, career stereotypic behavior patterns seem to start very early in life. Once a student does enter school, his/her decisions reflect these stereotypes so that by junior and senior high school many career possibilities are truely out of reach unless drastic remedial measures are taken. Early intervention measures, such as SCAT, may "slow down" or "reverse" these trends.

Lastly, the highly interactive computer dialogues were well received by the students. They easily learned how to use the light pens and keyboard. They enjoyed exploring the career choices, working the simulated problems and looking at illustrations. Students are eager to learn and are responsive to information presented in an interesting and innovative manner.

On the whole, the SCAT program implementation and evaluation proved successful in introducing late elementary school children to new science careers by using a highly interactive computer-based system. It also raised some questions which relate to how career choices are developed over time, starting at a very early age and continuing through high school and college and, indeed, throughout life.

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APPENDICES

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APPENDIX A

Excerpt from a SCAT dialogue entitled "The Work of the Biologist"

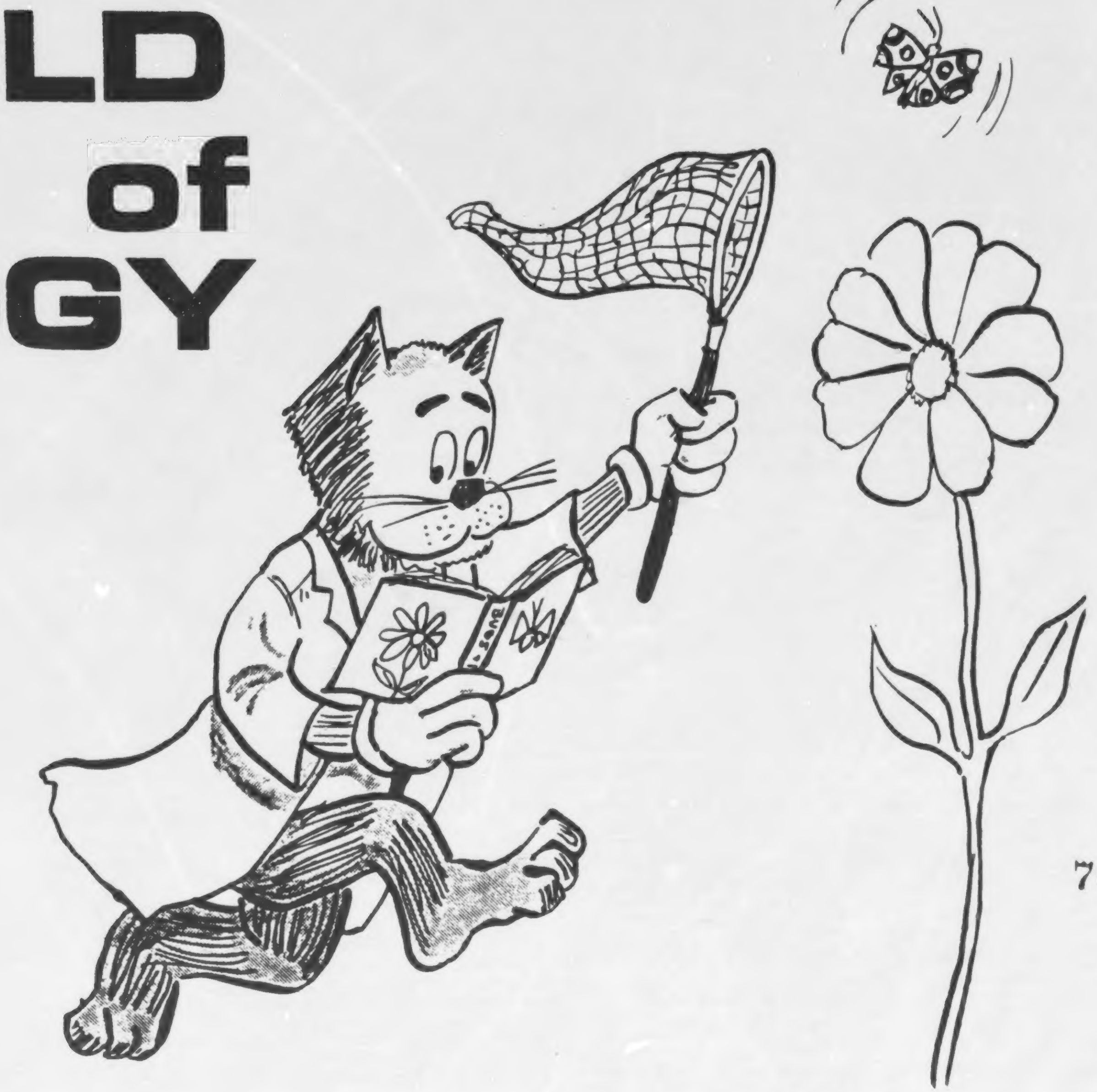
The following is an excerpt from the SCAT dialogue, "The Work of the Biologist." The frames are presented just as they appear to the student. Any comments or aids to the reader are written in italics so as to distinguish them from the actual dialogue frames. Asterisks indicate a break in the normal flow of the dialogue, i.e., the omission of one or more frames.

The dialogues are branched as a function of the student's response as follows:

CA	Indicates the computer response to a correct answer
WA	Indicates the computer response to a wrong answer
2nd WA	Indicates the computer response to two consecutive wrong answers.

Throughout the dialogue, the student is referred to color-coded pictures in the SCAT photo album. The photo album, designed in flip-chart style, was placed on a pedestal next to the computer console.

The WORLD of BIOLOGY



Hi Shirl
Welcome to the world
of Biologist!

Biology is the science of life. A biologist is a scientist who works with living things. Biologists study all kinds of plants and animals.

Shirl, use the light pen to point to your answer.

A biologist studies
- Cars and bicycles
- Plants and animals
- Rocks and minerals

CA	You're right! A biologist studies living things.
Either WA	Not quite. Hint: A biologist studies living things. Let's try the question again.
2nd WA	A biologist studies living things. Biologists study plants and animals.

You've seen that biologists work with plants and animals.

Now point the light pen to your choice:

1. Tell me about biologists and their work.
2. Let me choose a different scientist.

Student chooses to continue:

Turn to the green page 1.

(Student finds Biologist photos, page 1.)

The biologists on page 1 are working with animals. They are trying to learn more about these living things .

Biologists who work with animals have a special name. They are called zoologists.

Zoologists often study only one kind of animal. For example, some zoologists work only with fish or only with birds. Others work only with snakes or with insects.

The student continues through the dialogue to find out about other biologists such as botanists and ecologists. He/she finds out the different places biologists work and the kinds of problems they might study....

* * * * * * * * * * * * * * *

The biologists on page 2 are working with plants. One is trying to grow a new kind of corn which will give more food.

(Student turns to photos on page 2.)

A biologist who works with plants is called a botanist.

* * * * * * * * * * * * * * * *

Many biologists work in Laboratories like those on page 3. Just like the biologists who work outdoors, these biologists try to learn more about living things.

(Student turns to photos on page 3.)

One biologist on page 3 is studying a virus. Viruses are very tiny living things which may cause a sickness. They can give people colds or the flu. Biologists try to learn more about viruses to help people stay well.

After learning about the different kinds of biologists, the work they do, and the places they might work, the student has the option of either working through a problem similar to one a biologist might have or finding out more about the work of biologists and then working through the problem....

You've learned something about the work of a biologist.
Now use the light pen to choose:
1. Tell me more about biologists and let me help a biologist work.
2. Let me help a biologist work.

The student chooses to help a biologist work:

Let's help a biologist who studies living things in their natural environment.

The biologists on page 5 work with a pond environment. They study things in and around the water.

(Student turns to photos on page 5.)

Now look at page 6. Let's help the biologist find the answer to a question about this pond environment. First you need to be an observer and look at the things in this pond.

(Student turns to photos on page 6.)

* * * * * * * * * * * * * * * *

This pond has some different kinds of plants. One kind looks like green scum on top of the water.

Look at the pond again. Then point the light pen to the name of this "green scum" plant:

Algae
Cattails

CA

That's Right!

The green scum on top of the water is a plant called algae.

WA

The green scum on top of the water is a plant called algae.

Very tiny algae live in all parts of the pond. These algae make the water look green. When there are lots of algae in one place, they may hook together to make the green scum you see on page 6.

* * * * * * * * * * * * * * * *

Look at the algae on the pond. They are growing on only one part of the pond. Why don't the algae grow on top of the rest of the pond? You are going to help the Biologist answer this question.

The student is led to choose "sunlight" as the probable cause of the algae growth. He/she then tests this idea by following through an experiment in which pond water is placed in 3 jars positioned where each receives different amounts of sunlight. By the end of the experiment the student is able to conclude that the algae grew in the pond where there was more sunlight....

The experiment showed you that algae grow best in a lot of sunlight. Now point the light pen to why algae grow on top of only one part of the pond:

The algae part of the pond gets more sunlight than the rest.

There were no snails in the algae part of the pond.

CA

The algae part of the pond gets more sunlight than the rest.

Great! The biologist needs more helpers like you!

WA

Algae grow on top of only one part of the pond because that part gets more sunlight than the rest. Snails live in all parts of the pond.

If you set up a fish tank in your classroom, you would not want the algae scum to grow in it. Point the light pen to where you would put the fish tank so algae would not grow:

Near a window with a lot of sunlight
Near a window with only a little sun

CA

Excellent!

WA

Remember: A lot of sunlight helps algae grow.
You would put the fish tank near a window with only a little sunlight.

Thank you for helping the biologist! Would you like to be a biologist someday? Use the light pen.

Yes Maybe No

Please tell your teacher that
you have finished the biologist!
See you later, Shirl.
Now type sign off and then press ENTER.

APPENDIX B

Instruments Used to Measure Knowledge About Science Careers and Interest in Science as a Career - Final Version

Knowledge Test

Interest Tests

a. Science Career Interest
b. General Science Interest
c. Interest in SCAT Careers
d. Science Career Choice

KNOWLEDGE TEST

Directions: Place a circle around the letter in front of the words which best complete each sentence. If you are not sure of the answer, put a circle around (d).

1. Scientists are men and women who study
   - a. our country's laws.
   - b. living and nonliving things.
   - c. the history of the world.
   - d. I'm not sure.

2. Most scientists try to find answers to their questions by
   - a. writing reports
   - b. studying other planets
   - c. doing an experiment.
   - d. I'm not sure.

3. Biologists
   - a. work with plants and animals.
   - b. work with rocks, air, and oceans.
   - c. learn what things are made of.
   - d. I'm not sure.

4. Which of the following is a health scientist?
   - a. physicist.
   - b. dentist.
   - c. geologist.
   - d. I'm not sure.

CONTINUE TO NEXT PAGE

5. Chemists

   a. work with shapes and numbers.

   b. find out what people think.

   c. learn what things are made of.

   d. I'm not sure.

6. A zoologist might study

   a. soil.

   b. camels.

   c. roses.

   d. I'm not sure.

7. Mathematicians

   a. design and build roads and buildings.

   b. work with shapes and numbers.

   c. study man and how he lives.

   d. I'm not sure.

8. A botanist works with

   a. rocks.

   b. plants.

   c. animals.

   d. I'm not sure.

9. A physicist might learn about

   a. light from the sun

   b. shells form the sea.

   c. rocks from a mountain.

   d. I'm not sure

CONTINUE TO NEXT PAGE

10. Social scientists

    a. work with numbers and shapes.

    b. work with plants and animals.

    c. study man and how he lives.

    d. I'm not sure.

11. Engineers

    a. design and build roads, buildings and radios.

    b. find out how people make a living.

    c. try to find cures for diseases.

    d. I'm not sure.

12. A geologist may be called a(n)

    a. physicist.

    b. biologist.

    c. earth scientist

    d. I'm not sure.

13. Physicists

    a. study man and how he lives.

    b. work with plants and animals.

    c. learn about energy and matter.

    d. I'm not sure.

14. Meteorologists learn about

    a. stars.

    b. rocks.

    c. the weather.

    d. I'm not sure.

CONTINUE TO NEXT PAGE

15. Which scientist studies how cave men lived?

    a. physician.
    b. anthropologist.
    c. economist.
    d. I'm not sure.

16. Health scientists

    a. find out what people think.
    b. learn about the weather.
    c. help people who are hurt or sick
    d. I'm not sure.

17. A good way to find out attitudes or opinions is by

    a. writing a report.
    b. doing a survey
    c. reading a book.
    d. I'm not sure.

18. Earth scientists

    a. learn about diseases and help people who are sick.
    b. learn about rocks, oceans, and air.
    c. study man and how he lives.
    d. I'm not sure.

19. A chemical test tells us

    a. what people think.
    b. what things are made of.
    c. how things work.
    d. I'm not sure.

CONTINUE TO NEXT PAGE

20. In their work, engineers try to find out

a. how people spend their money.

b. what the weather will be like.

c. how to make better products.

d. I'm not sure.

21. A scientist who might help plan the path of a spaceship is

a. a mathematician.

b. a biologist.

c. an economist.

d. I'm not sure.

22. An astronomer studies

a. air pollution.

b. shapes and numbers.

c. stars and planets.

d. I'm not sure.

23. In their work health scientists may try to find

a. new ways to make electricity.

b. what other planets are made of.

c. cures for diseases.

d. I'm not sure.

24. The scientist who tries to find out what rocks from the moon are made of is a

a. sociologist.

b. chemist.

c. botanist.

d. I'm not sure.

CONTINUE TO NEXT PAGE

25. A scientist who designs cars and airplanes is

a. a chemist.

b. an engineer.

c. a social scientist.

d. I'm not sure.

26. In his work a mathematician might

a. operate a cash register.

b. write a secret code.

c. sell tickets to a game.

d. I'm not sure.

SCIENCE CAREER INTEREST

Directions: Place an (x) beside the things you might like to do when you grow up. Answer every question. Select one answer from each pair even if you really don't want to do either.

WOULD YOU RATHER...

______ 1. a. help take care of sick people?
______ b. be in a circus?

______ 2. a. be a police officer?
______ b. work with animals and plants?

______ 3. a. work with rocks, the weather or the oceans?
______ b. sell things in a store?

______ 4. a. run your own business?
______ b. work with chemicals and test tubes?

______ 5. a. study about people?
______ b. be a lawyer or a judge?

______ 6. a. drive a bus or taxi?
______ b. design and build roads, radios, airplanes?

______ 7. a. work with numbers, shapes and computers?
______ b. work for a radio or TV station?

______ 8. a. act in plays or movies?
______ b. study the planets and stars?

______ 9. a. work in a laboratory?
______ b. be in sports?

______ 10. a. teach in an elementary school?
______ b. be a science teacher?

GENERAL SCIENCE INTEREST

Directions: For each pair of sentences, check the one thing you would rather do. You must choose one of the two things.

WOULD YOU RATHER...

______ 1. a. Take a book from the library on dinosaurs?
______ b. Take out a book from the library on ghost stories?

______ 2. a. Visit an art gallery?
______ b. Visit the zoo?

______ 3. a. Make up a new word game?
______ b. Make up a secret code with numbers?

______ 4. a. Plan a science fair?
______ b. Begin a school newspaper?

______ 5. a. Learn why people sometimes argue?
______ b. Learn how to write stories for a newspaper?

______ 6. a. Make posters telling people not to litter?
______ b. Find out how air pollution harms our health?

______ 7. a. Put together a model airplane?
______ b. Do a paint-by-number drawing?

______ 8. a. Work with clay and paints?
______ b. Work with chemicals and test tubes?

______ 9. a. Take piano lessons?
______ b. Take lessons on first-aid?

______ 10. a. Receive a camera as a gift?
______ b. Receive a calculator as a gift?

CONTINUE TO NEXT PAGE

WOULD YOU RATHER...

______ 11. a. Learn how to make a magnet?
______ b. Learn how to weave baskets?

______ 12. a. Visit a factory?
______ b. Visit a weather station?

______ 13. a. Help set up an aquarium in the classroom?
______ b. Learn how to make ice cream?

______ 14. a. Draw a picture for the cover of your favorite book?
______ b. Draw a picture showing a city of the future?

______ 15. a. Write a report on how Eskimos live?
______ b. Write a report on your favorite TV star?

______ 16. a. Visit a hospital?
______ b. Visit a courtroom?

______ 17. a. Make up a comic strip?
______ b. Draw a floor-plan of your school?

______ 18. a. Collect rocks and shells?
______ b. Collect stamps and coins?

______ 19. a. Have a senator visit your class?
______ b. Have an astronaut visit your class?

______ 20. a. Go to see a movie?
______ b. Visit a museum?

______ 21. a. Learn how to make a clock?
______ b. Learn how to make puppets?

CONTINUE TO NEXT PAGE

WOULD YOU RATHER...

______ 22. a. Find out what holidays people celebrate in other lands?
______ b. Write about how you celebrated your favorite holiday?

______ 23. a. Make up a story about a dog that talks?
______ b. Make up a story about a trip to Mars?

______ 24. a. Find out about the history of ice skates?
______ b. Find out who invented the first microscope?

______ 25. a. Get a watch for your birthday?
______ b. Get a chemistry set for your birthday?

______ 26. a. Make a new chemical from vinegar and baking soda?
______ b. Make a salt and flour map of your state?

______ 27. a. Work crossword puzzles?
______ b. Work math problems on the calculator?

______ 28. a. Look through a microscope?
______ b. Take pictures?

______ 29. a. Watch a TV show about history?
______ b. Watch a TV show about animals?

______ 30. a. Learn how to tie dye?
______ b. Learn how bees make honey?

INTEREST IN SCAT CAREERS

CIRCLE THE WAY YOU FEEL:

Would you like to become a Biologist?	YES	MAYBE	NO
Would you like to become a Chemist?	YES	MAYBE	NO
Would you like to become an Earth Scientist?	YES	MAYBE	NO
Would you like to become an Engineer?	YES	MAYBE	NO
Would you like to become a Health Scientist?	YES	MAYBE	NO
Would you like to become a Mathematician?	YES	MAYBE	NO
Would you like to become a Physicist?	YES	MAYBE	NO
Would you like to become a Social Scientist?	YES	MAYBE	NO

SCIENCE CAREER CHOICE

What is the one thing you really want to be when you grow up?

____

APPENDIX C

Results of Analyses of Covariance of Raw Knowledge Test Scores

1976-66 6-Dialogue Sample

Tables C.1-4	Means and Standard Deviations of 1976 Pretest, 1976 Posttest, 1977 Pretest and 1977 Posttest by Treatment Group, Sex, Race and Grade
Tables C.5-7	Results (F-Ratios) of Analyses of Covariance
Table C.8	Adjusted Means Resulting From the Analyses of Covariance

1976 3-Dialogue Sample

Tables C.9-10	Means and Standard Deviations of 1976 Pretest and 1976 Posttest by Treatment Group, Sex, Race and Grade
Table C.11	Results (F-Ratios) of Analyses of Covariance
Table C.12	Adjusted Means Resulting from the Analyses of Covariance

1977 3-Dialogue Sample

Tables C.13-14	Means and Standard Deviations of 1977 Pretest and 1977 Posttest by Treatment Group, Sex, Race and Grade
Table C.15	Results (F-Ratios) of Analyses of Covariance
Table C.16	Adjusted Means Resulting from the Analyses of Covariance

Table C.1 6-Dialogue Sample. 1976 Pretest Knowledge Test Score N's, Means and Standard Deviations For SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	13	4.1	94	13	4.5	82	12	3.4	127	13	3.9	49	11	4.1
Gr 4	83	11	3.4	40	12	3.9	43	11	2.7	58	12	3.2	25	11	3.7
Gr 5	93	13	4.3	54	14	4.9	39	13	3.5	69	14	4.0	24	11	4.6
Male	94	13	4.5	-	-	-	-	-	-	65	14	4.0	29	10	4.8
Female	82	12	3.4	-	-	-	-	-	-	62	12	3.5	20	12	2.9
White	127	13	3.9	65	14	4.0	62	12	3.5	-	-	-	-	-	-
Minority	49	11	4.1	29	10	4.8	20	12	2.9	-	-	-	-	-	-
NO SCAT															
Total	109	12	4.0	35	12	4.1	74	12	4.0	75	12	3.9	34	11	4.3
Gr 4	50	11	3.3	18	11	3.7	32	11	3.1	33	11	3.3	17	11	3.3
Gr 5	59	12	4.5	17	13	4.4	42	12	4.5	42	12	4.3	17	12	5.1
Male	35	12	4.1	-	-	-	-	-	-	22	12	4.4	13	12	3.6
Female	74	12	4.0	-	-	-	-	-	-	53	12	3.7	21	11	4.7
White	75	12	3.9	22	12	4.4	53	12	3.7	-	-	-	-	-	-
Minority	34	11	4.3	13	12	3.6	21	11	4.7	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	12	4.0	129	13	4.4	156	12	3.7	202	13	3.9	83	11	4.2
Gr 4	133	11	3.3	58	12	3.9	75	11	2.8	91	12	3.2	42	11	3.5
Gr 5	152	13	4.4	71	13	4.8	81	13	4.1	111	14	4.2	41	12	4.8
Male	129	13	4.4	-	-	-	-	-	-	87	14	4.2	42	11	4.5
Female	156	12	3.7	-	-	-	-	-	-	115	12	3.6	41	12	3.9
White	202	13	3.9	87	14	4.2	115	12	3.6	-	-	-	-	-	-
Minority	83	11	4.2	42	11	4.5	41	12	3.9	-	-	-	-	-	-

Table C.2 6-Dialogue Sample. 1976 Posttest Knowledge Test Score N's, Means and Standard Deviations For SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	14	4.4	94	15	4.6	82	14	4.2	127	15	4.1	49	13	5.0
Gr 4	83	13	4.0	40	14	4.2	43	12	3.5	58	14	3.7	25	12	4.7
Gr 5	93	15	4.6	54	15	4.8	39	15	4.2	69	16	4.2	24	14	5.3
Male	94	15	4.6	-	-	-	-	-	-	65	16	4.0	29	13	5.2
Female	82	14	4.2	-	-	-	-	-	-	62	14	4.0	20	13	4.8
White	127	15	4.1	65	16	4.0	62	14	4.0	-	-	-	-	-	-
Minority	49	13	5.0	29	13	5.2	20	13	4.8	-	-	-	-	-	-
NO SCAT															
Total	109	12	4.2	35	11	5.0	74	12	3.9	75	12	4.1	34	12	4.7
Gr 4	50	11	4.0	18	11	5.1	32	11	3.3	33	11	4.1	17	11	3.9
Gr 5	59	12	4.4	17	12	4.5	42	12	4.2	42	12	4.0	17	13	5.3
Male	35	11	5.0	-	-	-	-	-	-	22	11	4.9	13	12	5.2
Female	74	12	3.9	-	-	-	-	-	-	53	12	3.7	21	12	4.4
White	75	12	4.1	22	11	4.9	53	12	3.7	-	-	-	-	-	-
Minority	34	12	4.7	13	12	5.2	21	12	4.4	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	13	4.5	129	14	4.9	156	13	4.1	202	14	4.3	83	12	4.9
Gr 4	133	12	4.1	58	13	4.8	75	12	3.4	91	13	4.0	42	12	4.4
Gr 5	152	14	4.7	71	15	5.0	81	14	4.5	111	14	4.5	41	13	5.2
Male	129	14	4.9	-	-	-	-	-	-	87	15	4.7	42	12	5.2
Female	156	13	4.1	-	-	-	-	-	-	115	13	4.0	41	12	4.6
White	202	14	4.3	87	15	4.7	115	13	4.0	-	-	-	-	-	-
Minority	83	12	4.9	42	12	5.2	41	12	4.6	-	-	-	-	-	-

Table C.3 6-Dialogue Sample. 1977 Pretest Knowledge Test Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	17	4.4	94	18	4.5	82	17	4.2	127	18	4.3	49	16	4.4
Gr 4	83	16	4.7	40	17	5.0	43	15	4.2	58	17	4.3	25	14	5.2
Gr 5	93	19	3.7	54	19	3.9	39	19	3.4	69	19	3.9	24	17	2.5
Male	94	18	4.5	-	-	-	-	-	-	65	19	4.7	29	17	3.5
Female	82	17	4.2	-	-	-	-	-	-	62	17	3.6	20	15	5.2
White	127	18	4.3	65	19	4.7	62	17	3.6	-	-	-	-	-	-
Minority	49	16	4.4	29	17	3.5	20	15	5.2	-	-	-	-	-	-
NO SCAT															
Total	109	16	4.0	35	17	4.3	74	16	3.8	75	17	4.0	34	16	3.9
Gr 4	50	15	4.4	18	16	5.1	32	15	3.9	33	15	4.5	17	14	4.0
Gr 5	59	18	3.1	17	18	2.9	42	18	3.2	42	18	3.2	17	17	2.9
Male	35	17	4.3	-	-	-	-	-	-	22	17	3.9	13	15	4.6
Female	74	16	3.8	-	-	-	-	-	-	53	16	4.0	21	16	3.3
White	75	17	4.0	22	17	3.9	53	16	4.0	-	-	-	-	-	-
Minority	34	16	3.9	13	15	4.6	21	16	3.3	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	17	4.2	129	18	4.5	156	17	4.0	202	18	4.2	83	16	4.1
Gr 4	133	16	4.6	58	17	5.0	75	15	4.1	91	16	4.4	42	14	4.7
Gr 5	152	18	3.5	71	18	3.7	81	18	3.3	111	19	3.7	41	17	2.6
Male	129	18	4.5	-	-	-	-	-	-	87	18	4.5	42	16	3.9
Female	156	17	4.0	-	-	-	-	-	-	115	17	3.8	41	15	4.4
White	202	18	4.2	87	18	4.5	115	17	3.8	-	-	-	-	-	-
Minority	83	16	4.1	42	16	3.9	41	15	4.4	-	-	-	-	-	-

Table C.4 6-Dialogue Sample. 1977 Posttest Knowledge Test Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	18	5.2	94	19	5.1	82	17	5.2	127	19	5.3	49	17	4.9
Gr 4	83	16	5.8	40	18	5.8	43	15	5.7	58	16	6.4	25	16	4.5
Gr 5	93	20	3.9	54	20	4.4	39	20	3.0	69	21	3.1	24	18	5.3
Male	94	19	5.1	-	-	-	-	-	-	65	19	5.0	29	18	5.3
Female	82	17	5.2	-	-	-	-	-	-	62	18	5.5	20	16	4.0
White	127	19	5.3	65	19	5.0	62	18	5.5	-	-	-	-	-	-
Minority	49	17	4.9	29	18	5.3	20	16	4.0	-	-	-	-	-	-
NO SCAT															
Total	109	16	5.8	35	15	6.5	74	16	5.4	75	16	5.5	34	14	6.2
Gr 4	50	14	5.2	18	15	6.4	32	14	4.5	33	15	5.0	17	13	5.4
Gr 5	59	17	6.0	17	16	6.8	42	17	5.8	42	17	5.8	17	16	6.7
Male	35	15	6.5	-	-	-	-	-	-	22	16	6.6	13	14	6.3
Female	74	16	5.4	-	-	-	-	-	-	53	16	5.1	21	15	6.2
White	75	16	5.5	22	16	6.6	53	16	5.1	-	-	-	-	-	-
Minority	34	14	6.2	13	14	6.3	21	15	6.2	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	17	5.6	129	18	5.8	156	17	5.3	202	18	5.5	83	16	5.6
Gr 4	133	16	5.7	58	17	6.1	75	15	5.2	91	16	5.9	42	15	5.1
Gr 5	152	19	5.1	71	19	5.4	81	18	4.9	111	19	4.7	41	17	5.9
Male	129	18	5.8	-	-	-	-	-	-	87	19	5.6	42	17	5.9
Female	156	17	5.3	-	-	-	-	-	-	115	17	5.4	41	15	5.2
White	202	18	5.5	87	19	5.6	115	17	5.4	-	-	-	-	-	-
Minority	83	16	5.6	42	17	5.9	41	15	5.2	-	-	-	-	-	-

Table C.5 6-Dialogue Sample. Results of Analyses of Covariance of Knowledge Raw Scores Using 1977 Pretest as the Dependent Variable and 1976 Pretest as the Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	1646.51	142.90**
	Main Effect			
	Treatment (TR)	1	15.82	1.373
	Grade (GR)	1	221.95	19.262**
	Sex	1	12.08	1.048
	Interactions			
	TR x GR	1	1.48	.128
	TR x SEX	1	2.63	.228
	GR x SEX	1	25.56	2.218
	TR x GR x SEX	1	.74	.064
	Residual	276	11.52	
	Raw Regression Coefficient			.597
Treatment by Grade by Race	Covariate	1	1646.51	144.22**
	Main Effect			
	Treatment (TR)	1	21.39	1.874
	Grade (GR)	1	220.43	19.307**
	Race (R)	1	44.09	3.862*
	Interactions			
	TR x GR	1	3.24	.284
	TR x R	1	.63	.055
	GR x R	1	21.71	1.901
	TR x GR x R	1	4.98	.436
	Residual	276	11.42	
	Raw Regression Coefficient			.597
Treatment by Sex by Race	Covariate	1	1646.51	139.96**
	Main Effect			
	Treatment (TR)	1	10.01	.838
	Sex	1	19.18	1.607
	Race (R)	1	52.72	4.417*
	Interactions			
	TR x SEX	1	8.58	.719
	TR x R	1	1.49	.125
	SEX x R	1	6.68	.560
	TR x SEX x R	1	74.84	6.271*
	Residual	276	11.94	
	Raw Regression Coefficient			.597

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table C.6 6-Dialogue Sample. Results of Analyses of Covaraince of Knowledge Raw Scores Using 1977 Posttest as the Dependent Variable and 1976 Pretest as the Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	1800.50	79.60**
	Main Effect			
	Treatment (TR)	1	308.01	13.618**
	Grade (GR)	1	299.10	13.223**
	Sex	1	12.44	.550
	Interactions			
	TR x GR	1	28.59	1.264
	TR x SEX	1	27.44	1.213
	GR x SEX	1	72.26	3.195
	TR x GR x SEX	1	1.19	.053
	Residual	284	30.98	
	Raw Regression Coefficient			.624
Treatment by Grade by Race	Covariate	1	1800.50	78.97**
	Main Effect			
	Treatment (TR)	1	343.43	15.062**
	Grade (GR)	1	298.43	13.089**
	Race (R)	1	22.23	.975
	Interactions			
	TR x GR	1	17.01	.746
	TR x R	1	16.35	.717
	GR x R	1	1.59	.070
	TR x GR x R	1	19.26	.845
	Residual	276	22.80	
	Raw Regression Coefficient			.624
Treatment by Sex by Race	Covariate	1	1800.50	76.52**
	Main Effect			
	Treatment (TR)	1	279.76	11.890**
	Sex	1	18.42	.783
	Race (R)	1	28.88	1.227
	Interactions			
	TR x SEX	1	39.15	1.664
	TR x R	1	8.79	.374
	SEX x R	1	10.42	.443
	TR x SEX x R	1	67.36	2.863
	Residual	276	23.53	
	Raw Regression Coefficient			.624

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table C.7 6-Dialogue Sample. Results of Analyses of Covariance of Knowledge Raw Scores Using 1977 Posttest as the Dependent Variable and 1977 Pretest as the Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	2530.61	120.54**
	Main Effect			
	Treatment (TR)	1	257.27	12.254**
	Grade (GR)	1	111.51	5.311*
	Sex	1	5.97	.285
	Interactions			
	TR x GR	1	46.22	2.202
	TR x SEX	1	20.86	.994
	GR x SEX	1	35.58	1.694
	TR x GR x SEX	1	.03	.001
	Residual	276	20.99	
	Raw Regression Coefficient			.703
Treatment by Grade by Race	Covariate	1	2530.61	121.15**
	Main Effect			
	Treatment (TR)	1	282.60	13.529**
	Grade (GR)	1	112.21	5.372*
	Race (R)	1	7.26	.348
	Interactions			
	TR x GR	1	34.34	1.644
	TR x R	1	11.29	.540
	GR x R	1	23.19	1.110
	TR x GR x R	1	46.79	2.240
	Residual	276	20.89	
	Raw Regression Coefficient			.703
Treatment by Sex by Race	Covariate	1	2530.61	117.39**
	Main Effect			
	Treatment (TR)	1	237.72	11.027**
	Sex	1	7.45	.345
	Race (R)	1	8.03	.372
	Interactions			
	TR x SEX	1	23.53	1.091
	TR x R	1	8.02	.372
	SEX x R	1	.00	.000
	TR x SEX x R	1	1.32	.061
	Residual	276	21.56	
	Raw Regression Coefficient			.703

Level of significance: * $p \le .05$; ** $p \le .01$

Table C.8 6-Dialogue Sample. Adjusted Means of the Dependent Variable Resulting From the Analyses of Covariance

	Adjusted Dependent Variable Means		
	1977 Posttest With 1976 Pretest as Covariate	1977 Posttest With 1977 Pretest as Covariate	1977 Pretest With 1976 Pretest as Covariate
SCAT	18	18	17
NO-SCAT	16	16	17
MALE	17	17	17
FEMALE	17	17	17
WHITE	17	17	17
MINORITY	17	17	16
GRADE 4	16	17	16
GRADE 5	18	18	18

Table C.9 1976 3-Dialogue Sample. 1976 Pretest Knowledge Test Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	345	12	4.4	173	13	4.7	172	12	4.1	215	14	3.9	130	10	4.4
Gr 4	115	11	4.0	56	11	4.8	59	11	3.3	69	12	3.2	46	9	4.6
Gr 5	120	13	4.5	62	13	5.1	58	12	3.8	78	14	4.1	42	10	4.4
Gr 6	110	14	4.1	55	14	3.7	55	14	4.6	68	15	3.9	42	12	3.9
Male	173	13	4.7	-	-	-	-	-	-	101	14	3.9	72	10	4.9
Female	172	12	4.1	-	-	-	-	-	-	114	13	3.9	58	10	3.7
White	215	14	3.9	101	14	3.9	114	13	3.9	-	-	-	-	-	-
Minority	130	10	4.2	72	10	4.9	58	10	3.7	-	-	-	-	-	-
NO SCAT															
Total	294	12	4.5	120	12	4.9	174	12	4.3	202	13	4.4	92	11	4.2
Gr 4	94	11	3.5	36	10	3.8	58	11	3.3	62	11	3.3	32	10	3.8
Gr 5	98	12	4.7	36	12	4.7	62	12	4.7	67	12	4.5	31	10	4.8
Gr 6	102	15	4.2	48	15	4.8	54	15	3.6	73	16	3.9	29	12	3.7
Male	120	12	4.9	-	-	-	-	-	-	84	13	4.9	36	10	4.4
Female	174	12	4.3	-	-	-	-	-	-	118	13	4.1	56	11	4.1
White	202	13	4.4	84	13	4.9	118	13	4.1	-	-	-	-	-	-
Minority	92	11	4.2	36	10	4.4	56	11	4.1	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	639	12	4.5	293	12	4.8	346	12	4.2	417	13	4.2	222	10	4.3
Gr 4	209	11	3.8	92	10	4.4	117	11	3.3	131	11	3.3	78	9	4.3
Gr 5	218	12	4.6	98	13	5.0	120	12	4.3	145	13	4.3	73	10	4.5
Gr 6	212	14	4.2	103	14	4.2	109	14	4.2	141	15	3.9	71	12	3.8
Male	293	12	4.8	-	-	-	-	-	-	185	14	4.4	108	10	4.8
Female	346	12	4.2	-	-	-	-	-	-	232	13	4.0	114	10	3.9
White	417	13	4.2	185	14	4.4	232	13	4.0	-	-	-	-	-	-
Minority	222	10	4.3	108	10	4.8	114	10	3.9	-	-	-	-	-	-

Table C.10 1976 3-Dialogue Sample. 1976 Posttest Knowledge Test Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	345	14	4.5	173	15	4.4	172	14	4.6	215	15	4.0	130	12	4.8
Gr 4	115	13	4.1	56	14	4.2	59	12	3.7	69	14	3.6	46	11	4.3
Gr 5	120	14	4.8	62	15	4.8	58	14	4.7	78	16	4.2	42	12	5.1
Gr 6	110	15	4.3	55	15	3.9	55	15	4.7	68	16	3.8	42	14	4.8
Male	173	15	4.4	-	-	-	-	-	-	101	16	4.0	72	13	4.7
Female	172	14	4.6	-	-	-	-	-	-	114	15	4.0	58	11	4.8
White	215	15	4.0	101	16	4.0	114	15	4.0	-	-	-	-	-	-
Minority	130	12	4.8	72	13	4.7	58	11	4.8	-	-	-	-	-	-
NO SCAT															
Total	294	12	4.8	120	12	5.3	174	12	4.4	202	13	4.8	92	11	4.3
Gr 4	94	10	4.0	36	10	4.5	58	10	3.8	62	11	4.0	32	10	4.0
Gr 5	98	12	4.7	36	12	5.3	62	12	4.4	67	13	4.5	31	10	4.9
Gr 6	102	15	4.6	48	14	5.4	54	15	3.7	73	16	4.1	29	11	3.7
Male	120	12	5.3	-	-	-	-	-	-	84	13	5.3	36	10	4.6
Female	174	12	4.4	-	-	-	-	-	-	118	13	4.3	56	11	4.0
White	202	13	4.8	84	13	5.3	118	13	4.3	-	-	-	-	-	-
Minority	92	11	4.3	36	10	4.6	56	11	4.0	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	639	13	4.7	293	14	4.9	346	13	4.5	417	14	4.5	222	12	4.7
Gr 4	209	12	4.2	92	12	4.6	117	11	3.8	131	12	4.1	78	11	4.2
Gr 5	218	13	4.9	98	14	5.2	120	13	4.7	145	14	4.6	73	12	5.1
Gr 6	212	15	4.4	103	15	4.7	109	15	4.2	141	16	4.0	71	13	4.6
Male	293	14	4.9	-	-	-	-	-	-	185	15	4.8	108	12	4.9
Female	346	13	4.5	-	-	-	-	-	-	232	14	4.2	114	11	4.5
White	417	14	4.5	185	15	4.8	232	14	4.2	-	-	-	-	-	-
Minority	222	12	4.7	108	12	4.9	114	11	4.5	-	-	-	-	-	-

Table C.11 1976 3-Dialogue Sample. Results of Analyses of Covariance of Knowledge Raw Scores Using 1976 Posttest as the Dependent Variable and 1976 Pretest as the Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	6495.07	582.58**
	Main Effect			
	Treatment (TR)	1	488.46	43.813**
	Grade (GR)	2	43.77	3.926*
	Sex	1	21.60	1.937
	Interactions			
	TR x GR	2	6.99	.627
	TR x SEX	1	19.60	1.758
	GR x SEX	2	23.94	2.147
	TR x GR x SEX	2	1.22	.109
	Residual	626	11.15	
	Raw Regression Coefficient			.717
Treatment by Grade by Race	Covariate	1	6495.07	588.30**
	Main Effect			
	Treatment (TR)	1	537.66	48.699**
	Grade (GR)	2	51.26	4.643*
	Race (R)	1	73.42	6.650*
	Interactions			
	TR x GR	2	7.22	.654
	TR x R	1	3.47	.314
	GR x R	2	7.83	.709
	TR x GR x R	2	33.70	3.052*
	Residual	626	11.04	
	Raw Regression Coefficient			.717
Treatment by Sex by Race	Covariate	1	6495.07	584.27**
	Main Effect			
	Treatment (TR)	1	499.28	44.913**
	Sex	1	28.16	2.534
	Race (R)	1	64.99	5.846*
	Interactions			
	TR x SEX	1	17.73	1.595
	TR x R	1	1.68	.151
	SEX x R	1	26.33	2.369
	TR x SEX x R	1	34.81	3.132
	Residual	630	11.12	
	Raw Regression Coefficient			.717

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table C.12 1976 3-Dialogue Sample. Adjusted Means of the Dependent Variable Resulting from the Analyses of Covariance

	Adjusted 1976 Posttest Means
SCAT	14
NO-SCAT	12
MALE	14
FEMALE	13
WHITE	14
MINORITY	13
GRADE 4	13
GRADE 5	13
GRADE 6	14

Table C.13 1977 3-Dialogue Sample. 1977 Pretest Knowledge Test Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	192	15	4.3	92	16	4.2	100	15	4.3	165	16	4.3	27	13	3.2
Gr 4	119	14	3.4	58	14	3.4	61	14	3.3	101	14	3.4	18	13	2.7
Gr 5	41	16	4.5	19	16	4.9	22	16	4.3	36	16	4.7	5	15	3.6
Gr 6	32	19	5.0	15	20	4.1	17	18	5.6	28	20	4.4	4	13	5.1
Male	92	16	4.2	-	-	-	-	-	-	81	16	4.3	11	14	3.5
Female	100	15	4.3	-	-	-	-	-	-	84	15	4.4	16	13	3.0
White	165	16	4.3	81	16	4.3	84	15	4.4	-	-	-	-	-	-
Minority	27	13	3.2	11	14	3.5	16	13	3.0	-	-	-	-	-	-
NO SCAT															
Total	253	13	5.2	129	13	5.7	124	13	4.5	190	14	5.0	63	12	5.3
Gr 4	108	12	4.8	53	11	5.2	55	12	4.5	75	12	4.5	33	10	5.2
Gr 5	64	13	4.7	33	13	5.5	31	13	3.7	53	13	4.4	11	13	6.1
Gr 6	81	16	4.9	43	17	5.1	38	15	4.5	62	17	4.9	19	14	4.0
Male	129	13	5.7	-	-	-	-	-	-	102	14	5.5	27	11	5.9
Female	124	13	4.5	-	-	-	-	-	-	88	14	4.3	36	12	4.8
White	190	14	5.0	102	14	5.5	88	14	4.3	-	-	-	-	-	-
Minority	63	12	5.3	27	11	5.9	36	12	4.8	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	445	14	4.9	221	14	5.3	224	14	4.4	355	15	4.7	90	12	4.8
Gr 4	227	13	4.3	111	13	4.6	116	13	3.9	176	13	4.0	51	11	4.7
Gr 5	105	14	4.8	52	14	5.5	53	14	4.1	89	14	4.7	16	13	5.5
Gr 6	113	17	5.0	58	17	5.0	55	16	5.0	90	18	4.9	23	14	4.1
Male	221	14	5.3	-	-	-	-	-	-	183	15	5.1	38	12	5.5
Female	224	14	4.4	-	-	-	-	-	-	172	15	4.3	52	12	4.3
White	355	15	4.7	183	15	5.1	172	15	4.3	-	-	-	-	-	-
Minority	90	12	4.8	38	12	5.5	52	12	4.3	-	-	-	-	-	-

Table C.14 1977 3-Dialogue Sample. 1977 Posttest Knowledge Test Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	192	17	4.8	92	18	4.4	100	16	5.2	165	18	4.7	27	14	4.5
Gr 4	119	16	4.4	58	17	4.2	61	15	4.5	101	16	4.5	18	14	3.4
Gr 5	41	17	3.7	19	17	3.9	22	18	3.6	36	17	3.9	5	17	1.1
Gr 6	32	21	5.7	15	22	2.9	17	20	7.3	28	22	3.3	4	10	8.5
Male	92	18	4.4	-	-	-	-	-	-	81	18	4.5	11	16	2.9
Female	100	16	5.2	-	-	-	-	-	-	84	17	4.9	16	13	5.1
White	165	18	4.7	81	18	4.5	84	17	4.9	-	-	-	-	-	-
Minority	27	14	4.5	11	16	2.9	16	13	5.1	-	-	-	-	-	-
NO SCAT															
Total	253	13	6.4	129	12	6.5	124	13	6.2	190	13	6.3	63	10	6.0
Gr 4	108	11	6.0	53	11	6.3	55	11	5.7	75	13	5.6	33	8	5.5
Gr 5	64	13	5.8	33	12	5.7	31	13	5.8	53	13	5.4	11	11	7.2
Gr 6	81	14	7.0	43	14	7.2	38	15	6.9	62	14	7.6	19	13	4.8
Male	129	12	6.5	-	-	-	-	-	-	102	13	6.5	27	10	6.1
Female	124	13	6.2	-	-	-	-	-	-	88	14	6.0	36	10	6.0
White	190	13	6.3	102	13	6.5	88	14	6.0	-	-	-	-	-	-
Minority	63	10	6.0	27	10	6.1	36	10	6.0	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	445	14	6.2	221	15	6.3	224	14	6.0	355	15	6.0	90	11	5.8
Gr 4	227	14	5.7	111	14	5.9	116	13	5.4	176	15	5.3	51	10	5.5
Gr 5	105	15	5.4	52	14	5.7	53	15	5.4	89	15	5.3	16	13	6.6
Gr 6	113	16	7.3	58	16	7.4	55	16	7.3	90	17	7.5	23	13	5.5
Male	221	15	6.3	-	-	-	-	-	-	183	15	6.3	38	12	5.9
Female	224	14	6.0	-	-	-	-	-	-	172	16	5.7	52	11	5.8
White	355	15	6.0	183	15	6.3	172	16	5.7	-	-	-	-	-	-
Minority	90	11	5.8	38	12	5.9	52	11	5.8	-	-	-	-	-	-

Table C.15 1977 3-Dialogue Sample. Results of Analyses of Covariance of Knowledge Raw Scores Using 1977 Posttest as the Dependent Variable and 1977 Pretest as Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	5934.37	268.49**
	Main Effect			
	Treatment (TR)	1	1042.21	47.152**
	Grade (GR)	2	8.02	.363
	Sex	1	.03	.001
	Interactions			
	TR x GR	2	35.24	1.594
	TR x SEX	1	26.48	1.198
	GR x SEX	2	35.69	1.615
	TR x GR x SEX	2	19.74	.893
	Residual	432	22.10	
	Raw Regression Coefficient			.752
Treatment by Grade by Race	Covariate	1	5934.37	277.58**
	Main Effect			
	Treatment (TR)	1	955.42	44.690**
	Grade (GR)	2	8.00	.374
	Race (R)	1	205.54	9.614*
	Interactions			
	TR x GR	2	43.83	2.050
	TR x R	1	2.05	.096
	GR x R	2	20.14	.942
	TR x GR x R	2	109.81	5.137*
	Residual	432	21.38	
	Raw Regression Coefficient			.752
Treatment by Sex by Race	Covariate	1	5934.37	274.47**
	Main Effect			
	Treatment (TR)	1	958.42	44.328**
	Sex	1	1.58	.073
	Race (R)	1	207.12	9.580*
	Interactions			
	TR x SEX	1	73.00	3.376
	TR x R	1	3.19	.147
	SEX x R	1	102.26	4.730*
	TR x SEX x R	1	4.52	.209
	Residual	436	21.62	
	Raw Regression Coefficient			.752

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table C.16 1977 3-Dialogue Sample. Adjusted Means of the Dependent Variable Resulting From the Analyses of Covariance

	Adjusted 1977 Posttest Means
SCAT	16
NO-SCAT	13
MALE	14
FEMALE	15
WHITE	15
MINORITY	13
GRADE 4	14
GRADE 5	15
GRADE 6	15

APPENDIX D

Results of Analyses of Variance of Knowledge Gain Scores for the 1976-77 6-Dialogue Sample

Tables D.1-3	Means and Standard Deviations of 1976 pretest to 1976 posttest gains, 1976 pretest to 1977 pretest gains and 1976 pretest to 1977 posttest gains by treatment, grade, sex and race
Tables D.4-6	Results (F-Ratios) of Analyses of Variance

Table D.1 6-Dialogue Sample. 1976 Pretest to 1976 Posttest Knowledge Gain Score N's, Means and Standard Deviations for SCAT, NO-SCAT, and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	1.8	3.6	94	1.9	3.6	82	1.6	3.6	127	1.7	3.5	49	1.9	3.8
Gr 4	83	1.7	3.7	40	2.2	3.6	43	1.3	3.7	58	1.9	3.7	25	1.3	3.5
Gr 5	93	1.8	3.5	54	1.8	3.6	39	1.9	3.5	69	1.6	3.3	24	2.5	4.1
Male	94	1.9	3.6	-	-	-	-	-	-	65	1.7	3.5	29	2.3	3.7
Female	82	1.6	3.6	-	-	-	-	-	-	62	1.7	3.5	20	1.2	3.9
White	127	1.7	3.5	65	1.7	3.5	62	1.7	3.5	-	-	-	-	-	-
Minority	49	1.9	3.8	29	2.3	3.7	20	1.2	3.9	-	-	-	-	-	-
NO SCAT															
Total	109	-.1	3.5	35	-.6	3.9	74	.2	3.3	75	-.3	3.4	34	.3	3.7
Gr 4	50	-.1	3.4	18	-.6	4.0	32	.2	3.1	33	-.4	3.6	17	.4	3.1
Gr 5	59	-.1	3.6	17	-.6	4.0	42	.2	3.4	42	-.1	3.3	17	.2	4.3
Male	35	-.6	3.9	-	-	-	-	-	-	22	-.9	3.7	13	-.1	4.3
Female	74	.2	3.3	-	-	-	-	-	-	53	.0	3.3	21	.5	3.3
White	75	-.3	3.4	22	-.9	3.7	53	.0	3.3	-	-	-	-	-	-
Minority	34	.3	3.7	13	-.1	4.3	21	.5	3.3	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	1.1	3.6	129	1.2	3.8	156	.9	3.5	202	1.0	3.6	83	1.2	3.8
Gr 4	133	1.0	3.7	58	1.3	3.9	75	.8	3.5	91	1.1	3.8	42	.9	3.4
Gr 5	152	1.1	3.6	71	1.2	3.8	81	1.0	3.5	111	.9	3.4	41	1.5	4.2
Male	129	1.2	3.8	-	-	-	-	-	-	87	1.1	3.7	42	1.6	4.0
Female	156	.9	3.5	-	-	-	-	-	-	115	.9	3.5	41	.8	3.6
White	202	1.0	3.6	87	1.1	3.7	115	.9	3.5	-	-	-	-	-	-
Minority	83	1.2	3.8	42	1.6	4.0	41	.8	3.6	-	-	-	-	-	-

Table D.2 6-Dialogue Sample. 1976 Pretest to 1977 Pretest Knowledge Gain Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	4.9	3.9	94	5.0	3.9	82	4.7	3.9	127	4.9	3.8	49	4.8	4.1
Gr 4	83	4.5	4.0	40	4.8	4.2	43	4.3	4.0	58	4.9	3.9	25	3.6	4.4
Gr 5	93	5.2	3.7	54	5.2	3.7	39	5.2	3.7	69	4.9	3.7	24	6.1	3.5
Male	94	5.0	3.9	-	-	-	-	-	-	65	4.5	3.9	29	6.1	3.6
Female	82	4.7	3.9	-	-	-	-	-	-	62	5.3	3.6	20	3.0	4.2
White	127	4.9	3.8	65	4.5	3.9	62	5.3	3.6	-	-	-	-	-	-
Minority	49	4.8	4.1	29	6.1	3.6	20	3.0	4.2	-	-	-	-	-	-
NO SCAT															
Total	109	4.6	3.9	35	4.6	3.9	74	4.7	3.9	75	4.8	3.9	34	4.2	3.8
Gr 4	50	3.8	4.3	18	4.4	4.5	32	3.5	4.3	33	4.0	4.5	17	3.4	4.1
Gr 5	59	5.4	3.3	17	4.8	3.3	42	5.6	3.3	42	5.5	3.2	17	5.0	3.5
Male	35	4.6	3.9	-	-	-	-	-	-	22	5.4	3.9	13	3.2	3.6
Female	74	4.7	3.9	-	-	-	-	-	-	53	4.6	3.9	21	4.8	3.9
White	75	4.8	3.9	22	5.4	3.9	53	4.6	3.9	-	-	-	-	-	-
Minority	34	4.2	3.8	13	3.2	3.6	21	4.8	3.9	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	4.8	3.9	129	4.9	3.9	156	4.7	3.9	202	4.9	3.8	83	4.6	4.0
Gr 4	133	4.3	4.7	58	4.6	4.3	75	3.9	4.1	91	4.6	4.1	42	3.5	4.2
Gr 5	152	5.6	5.5	71	5.1	3.6	81	5.4	3.5	111	5.1	3.5	41	5.7	3.5
Male	129	4.9	3.9	-	-	-	-	-	-	87	4.7	3.9	42	5.2	3.8
Female	156	4.7	3.9	-	-	-	-	-	-	115	5.0	3.7	41	3.9	4.1
White	202	4.9	3.8	87	4.7	3.9	115	5.0	3.7	-	-	-	-	-	-
Minority	83	4.6	4.0	42	5.2	3.8	41	3.9	4.1	-	-	-	-	-	-

Table D.3 6-Dialogue Sample. 1976 Pretest to 1977 Posttest Knowledge Gain Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	5.7	4.8	94	6.0	5.1	82	5.4	4.5	127	5.6	4.8	49	6.2	4.7
Gr 4	83	4.9	5.0	40	5.5	5.2	43	4.4	4.9	58	4.7	5.6	25	5.6	3.3
Gr 5	93	6.5	4.5	54	6.4	4.9	39	6.5	3.8	69	6.3	3.9	24	6.9	5.8
Male	94	6.0	5.1	-	-	-	-	-	-	65	5.3	4.9	29	7.6	5.1
Female	82	5.4	4.5	-	-	-	-	-	-	62	5.8	4.7	20	4.2	3.3
White	127	5.6	4.8	65	5.3	4.9	62	5.8	4.7	-	-	-	-	-	-
Minority	49	6.2	4.7	29	7.6	5.1	20	4.2	3.3	-	-	-	-	-	-
NO SCAT															
Total	109	3.8	5.6	35	3.3	5.6	74	4.0	5.7	75	4.2	5.3	34	3.0	6.3
Gr 4	50	3.3	4.0	18	3.8	3.7	32	3.0	4.2	33	3.8	3.5	17	2.4	4.8
Gr 5	59	4.3	6.7	17	2.9	7.1	42	4.8	6.5	42	4.5	6.3	17	3.7	7.7
Male	35	3.3	5.6	-	-	-	-	-	-	22	4.2	5.3	13	1.9	5.8
Female	74	4.0	5.7	-	-	-	-	-	-	53	4.2	5.3	21	3.8	6.7
White	75	4.2	5.3	22	4.2	5.3	53	4.2	5.3	-	-	-	-	-	-
Minority	34	3.0	6.3	13	1.8	5.8	21	3.8	6.7	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	5.0	5.2	129	5.3	5.3	156	4.8	5.1	202	5.0	5.0	83	4.9	5.6
Gr 4	133	4.2	4.2	58	5.0	4.8	75	3.8	4.6	91	4.3	5.0	42	4.3	4.2
Gr 5	152	5.3	3.5	71	5.6	5.7	81	5.6	5.4	111	5.6	5.0	41	5.6	6.8
Male	129	5.3	5.3	-	-	-	-	-	-	87	5.1	5.0	42	5.8	5.9
Female	156	4.8	5.1	-	-	-	-	-	-	115	5.0	5.0	41	4.0	5.2
White	202	5.0	5.0	87	5.1	5.0	115	5.0	5.0	-	-	-	-	-	-
Minority	83	4.9	5.6	42	5.8	5.9	41	4.0	5.2	-	-	-	-	-	-

Table D.4 6-Dialgoue Sample. Results of Analyses of Variance of Knowledge Gain Scores from 1976 Posttest Minus 1976 Pretest

TYPE OF ANALYSIS OF VARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex				
	Main Effect			
	Treatment (TR)	1	223.12	17.648**
	Grade (GR)	1	.62	.049
	Sex	1	.18	.014
	Interactions			
	TR x GR	1	.57	.045
	TR x SEX	1	18.51	1.464
	GR x SEX	1	6.71	.531
	TR x GR x SEX	1	3.81	.301
	Residual	227	12.64	
Treatment by Grade by Race				
	Main Effect			
	Treatment (TR)	1	232.78	18.409**
	Grade (GR)	1	.80	.063
	Race (R)	1	5.24	.415
	Interactions			
	TR x GR	1	.03	.002
	TR x R	1	2.39	.189
	GR x R	1	7.14	.565
	TR x GR x R	1	13.57	1.073
	Residual	227	12.65	
Treatment by Sex by Race				
	Main Effect			
	Treatment (TR)	1	225.67	17.906**
	Sex	1	.32	.026
	Race (R)	1	5.22	.414
	Interactions			
	TR x SEX	1	22.26	1.766
	TR x R	1	6.71	.532
	SEX x R	1	10.22	.811
	TR x SEX x R	1	2.40	.190
	Residual	227	12.60	

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table D.5 6-Dialogue Sample. Results of Analyses of Variance of Knowledge Gain Scores from 1977 Pretest Minus 1976 Pretest

TYPE OF ANALYSIS OF VARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex				
	Main Effect			
	Treatment (TR)	1	2.94	.198
	Grade (GR)	1	72.94	4.921*
	Sex	1	1.04	.070
	Interactions			
	TR x GR	1	8.01	.540
	TR x SEX	1	.76	.051
	GR x SEX	1	13.75	.928
	TR x GR x SEX	1	6.49	.438
	Residual	227	14.82	
Treatment by Grade by Race				
	Main Effect			
	Treatment (TR)	1	3.62	.247
	Grade (GR)	1	71.84	4.899*
	Race (R)	1	3.38	.231
	Interactions			
	TR x GR	1	10.28	.701
	TR x R	1	3.92	.267
	GR x R	1	37.79	2.577
	TR x GR x R	1	22.29	1.520
	Residual	227	14.66	
Treatment by Sex by Race				
	Main Effect			
	Treatment (TR)	1	2.03	.139
	Sex	1	2.24	.154
	Race (R)	1	5.68	.390
	Interactions			
	TR x SEX	1	3.28	.225
	TR x R	1	.52	.035
	SEX x R	1	32.84	2.251
	TR x SEX x R	1	127.08	8.711**
	Residual	227	14.59	

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table D.6 6-Dialogue Sample. Results of Analyses of Variance of Knowledge Gain Scores from 1977 Posttest Minus 1976 Pretest

TYPE OF ANALYSIS OF VARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex				
	Main Effect			
	Treatment (TR)	1	235.10	9.054**
	Grade (GR)	1	121.33	4.672*
	Sex	1	1.16	.045
	Interactions			
	TR x GR	1	13.85	.533
	TR x SEX	1	20.08	.773
	GR x SEX	1	50.97	1.963
	TR x GR x SEX	1	7.85	.302
	Residual	227	25.97	
Treatment by Grade by Race				
	Main Effect			
	Treatment (TR)	1	252.76	9.695**
	Grade (GR)	1	122.03	4.681*
	Race (R)	1	.002	.000
	Interactions			
	TR x GR	1	7.49	.287
	TR x R	1	46.48	1.783
	GR x R	1	.04	.002
	TR x GR x R	1	3.601	.138
	Residual	227	26.07	
Treatment by Sex by Race				
	Main Effect			
	Treatment (TR)	1	227.08	8.765**
	Sex	1	2.26	.087
	Race (R)	1	.40	.015
	Interactions			
	TR x SEX	1	26.97	1.041
	TR x R	1	23.31	.900
	SEX x R	1	38.91	1.502
	TR x SEX x R	1	114.75	4.429*
	Residual	227	25.91	

Level of significance: * $p \leq .05$; ** $p \leq .01$

APPENDIX E

Results of Analyses of Covariance of Interest Scores for the 1976-77 6-Dialogue Sample and the 1977 3-Dialogue Sample.

6-Dialogue Sample

--Science Career Interest Scores

Tables E.1-2	Means and Standard Deviations of 1977 Pretest and 1977 Posttest by Treatment Group, Sex, Race and Grade
Table E.3	Results (F-Ratios) of Analyses of Covariance
Table E.4	Adjusted Means Resulting from Analyses of Covariance

--General Science Interest Scores

Tables E.5-6	Means and Standard Deviations of 1977 Pretest and 1977 Posttest by Treatment Group, Sex, Race and Grade
Table E.7	Results (F-Ratios) of Analyses of Covariance
Table E.8	Adjusted Means Resulting from Analyses of Covariance

--Interest In SCAT Careers Scores

Tables E.9-10	Means and Standard Deviations of 1977 Pretest and 1977 Posttest by Treatment Group, Sex, Race and Grade
Table E.11	Results (F-Ratios) of Analyses of Covariance
Table E.12	Adjusted Means Resulting from Analyses of Covariance

1977 3-Dialogue Sample

--Science Career Interest Scores

Tables E.13-14	Means and Standard Deviations of 1977 Pretest and 1977 Posttest by Treatment Group, Sex, Race and Grade

Table E.15	Results (F-Ratios) of Analyses of Covariance
Table E.16	Adjusted Means Resulting from Analyses of Covariance
--General Science Interest Scores	
Tables E.17-18	Means and Standard Deviations of 1977 Pretest and 1977 Posttest by Treatment Group, Sex, Race and Grade
Table E.19	Results (F-Ratios) of Analyses of Covariance
Table E.20	Adjusted Means Resulting from Analyses of Covariance
--Interest in SCAT Careers Scores	
Tables E.21-22	Means and Standard Deviations of 1977 Pretest and 1977 Posttest by Treatment Group, Sex, Race and Grade
Table E.23	Results (F-Ratios) of Analyses of Covariance
Table E.24	Adjusted Means Resulting from Analyses of Covariance

Table E.1 6-Dialogue Sample. 1977 Pretest Science Career Interest Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	5.5	2.4	94	6.0	2.4	82	4.8	2.2	127	5.7	2.4	49	4.9	2.2
Gr 4	83	5.3	2.2	40	5.9	2.2	43	4.7	2.1	58	5.6	2.2	25	4.6	2.2
Gr 5	93	5.6	2.6	54	6.1	2.5	39	4.9	2.4	69	5.7	2.7	24	5.3	2.3
Male	94	6.0	2.4	-	-	-	-	-	-	65	6.4	2.3	29	5.2	2.3
Female	82	4.8	2.2	-	-	-	-	-	-	62	4.9	2.3	20	4.5	2.0
White	127	5.7	2.4	65	6.4	2.3	62	4.9	2.3	-	-	-	-	-	-
Minority	49	4.9	2.2	29	5.2	2.3	20	4.5	2.0	-	-	-	-	-	-
NO SCAT															
Total	109	5.4	2.4	35	5.7	2.4	74	5.3	2.4	75	5.6	2.3	34	5.1	2.5
Gr 4	50	5.8	2.2	18	6.6	2.3	32	5.3	2.0	33	5.9	2.2	17	5.5	2.3
Gr 5	59	5.1	2.5	17	4.7	2.1	42	5.3	2.6	42	5.3	2.4	17	4.7	2.8
Male	35	5.7	2.4	-	-	-	-	-	-	22	5.8	2.3	13	5.5	2.6
Female	74	5.3	2.4	-	-	-	-	-	-	53	5.5	2.3	21	4.9	2.5
White	75	5.6	2.3	22	5.8	2.3	53	5.5	2.3	-	-	-	-	-	-
Minority	34	5.1	2.5	13	5.5	2.6	21	4.9	2.5	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	5.4	2.4	129	5.9	2.4	156	5.0	2.3	202	5.6	2.4	83	5.0	2.3
Gr 4	133	5.5	2.2	58	6.1	2.2	75	5.0	2.1	91	5.7	2.2	42	5.0	2.2
Gr 5	152	5.4	2.5	71	5.8	2.5	81	5.1	2.5	111	5.6	2.5	41	5.0	2.5
Male	129	5.9	2.4	-	-	-	-	-	-	87	6.3	2.3	42	5.3	2.4
Female	156	5.0	2.3	-	-	-	-	-	-	115	5.2	2.3	41	4.7	2.3
White	202	5.6	2.4	87	6.3	2.3	115	5.2	2.3	-	-	-	-	-	-
Minority	83	5.0	2.3	42	5.3	2.4	41	4.7	2.3	-	-	-	-	-	-

Table E.2 6-Dialogue Sample. 1977 Posttest Science Career Interest Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	5.5	2.5	94	6.0	2.4	82	4.8	2.5	127	5.6	2.5	49	5.1	2.5
Gr 4	83	5.0	2.5	40	5.8	2.2	43	4.4	2.6	58	5.1	2.6	25	4.8	2.3
Gr 5	93	5.8	2.5	54	6.2	2.6	39	5.4	2.2	69	5.9	2.4	24	5.5	2.7
Male	94	6.0	2.4	-	-	-	-	-	-	65	6.3	2.4	29	5.4	2.5
Female	82	4.8	2.5	-	-	-	-	-	-	62	4.9	2.5	20	4.8	2.5
White	127	5.6	2.5	65	6.3	2.4	62	4.9	2.5	-	-	-	-	-	-
Minority	49	5.1	2.5	29	5.4	2.5	20	4.8	2.5	-	-	-	-	-	-
NO SCAT															
Total	109	5.2	2.9	35	5.5	3.0	74	5.0	2.8	75	5.2	2.9	34	5.0	2.8
Gr 4	50	5.4	2.7	18	6.3	2.7	32	4.9	2.6	33	5.6	2.8	17	5.1	2.4
Gr 5	59	4.9	3.0	17	4.6	3.0	42	5.1	3.0	42	5.0	3.0	17	4.8	3.1
Male	35	5.5	3.0	-	-	-	-	-	-	22	5.5	3.1	13	5.5	2.9
Female	74	5.0	2.8	-	-	-	-	-	-	53	5.1	2.9	21	4.7	2.7
White	75	5.2	2.9	22	5.5	3.1	53	5.1	2.9	-	-	-	-	-	-
Minority	34	5.0	2.8	13	5.5	2.9	21	4.7	2.7	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	5.3	2.7	129	5.9	2.6	156	4.9	2.6	202	5.4	2.7	83	5.1	2.6
Gr 4	133	5.2	2.6	58	5.9	2.3	75	4.6	2.6	91	5.3	2.7	42	4.9	2.3
Gr 5	152	5.5	2.7	71	5.8	2.8	81	5.2	2.7	111	5.6	2.7	41	5.2	2.9
Male	129	5.9	2.6	-	-	-	-	-	-	87	6.1	2.6	42	5.4	2.6
Female	156	4.9	2.6	-	-	-	-	-	-	115	5.0	2.7	41	4.7	2.6
White	202	5.4	2.7	87	6.1	2.6	115	5.0	2.7	-	-	-	-	-	-
Minority	83	5.1	2.6	42	5.4	2.6	41	4.7	2.6	-	-	-	-	-	-

Table E.3 6-Dialogue Sample. Results of Analyses of Covariance of Science Career Interest Scores Using 1977 Posttest as the Dependent Variable and 1977 Pretest as the Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	885.61	227.66 **
	Main Effect			
	Treatment (TR)	1	3.66	.940
	Grade (GR)	1	8.74	2.246
	Sex	1	2.79	.718
	Interactions			
	TR x GR	1	8.11	2.084
	TR x SEX	1	0.02	.004
	GR x SEX	1	7.16	1.841
	TR x GR x SEX	1	0.18	.045
	Residual	276	3.89	
	Raw Regression Coefficient		.745	
Treatment by Grade by Race	Covariate	1	885.61	226.870 **
	Main Effect			
	Treatment (TR)	1	5.56	1.425
	Grade (GR)	1	9.49	2.431
	Race (R)	1	1.40	.359
	Interactions			
	TR x GR	1	5.92	1.516
	TR x R	1	.08	.020
	GR x R	1	.24	.061
	TR x GR x R	1	4.31	1.104
	Residual	276	3.90	
	Raw Regression Coefficient		.745	
Treatment by Sex by Race	Covariate	1	885.61	223.42 **
	Main Effect			
	Treatment (TR)	1	3.60	.908
	Sex	1	2.85	.718
	Race (R)	1	0.70	.177
	Interactions			
	TR x SEX	1	.001	.000
	TR x R	1	.034	.009
	SEX x R	1	.011	.003
	TR x SEX x R	1	.52	.131
	Residual	276	3.96	
	Raw Regression Coefficient		.745	

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table E.4 6-Dialogue Sample. Adjusted Means of the Dependent Variable Resulting from the Analyses of Covariance

	Adjusted 1977 Posttest Means
SCAT	5
NO-SCAT	5
MALE	5
FEMALE	5
WHITE	5
MINORITY	5
GRADE 4	5
GRADE 5	5

Table E.5 6-Dialogue Sample. 1977 Pretest General Science Interest Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	17	5.7	94	19	5.2	82	15	5.3	127	17	5.7	49	17	5.6
Gr 4	83	16	5.7	40	18	5.4	43	14	5.3	58	16	5.6	25	15	6.1
Gr 5	93	18	5.4	54	20	4.9	39	16	5.2	69	18	5.7	24	18	4.5
Male	94	19	5.2	-	-	-	-	-	-	65	19	5.4	29	19	4.6
Female	82	15	5.3	-	-	-	-	-	-	62	15	5.1	20	14	5.9
White	127	17	5.7	65	19	5.4	62	15	5.1	-	-	-	-	-	-
Minority	49	17	5.6	29	19	4.6	20	14	5.9	-	-	-	-	-	-
NO SCAT															
Total	109	16	4.9	35	18	4.1	74	15	4.9	75	16	4.9	34	16	4.8
Gr 4	50	17	4.7	18	20	4.0	32	16	4.1	33	18	4.8	17	17	4.4
Gr 5	59	15	4.8	17	16	2.8	42	15	5.4	42	15	4.8	17	14	5.0
Male	35	18	4.1	-	-	-	-	-	-	22	19	3.8	13	17	4.3
Female	74	15	4.9	-	-	-	-	-	-	53	15	4.8	21	15	5.1
White	75	16	4.9	22	19	3.8	53	15	4.8	-	-	-	-	-	-
Minority	34	16	4.9	13	17	4.3	21	15	5.1	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	17	5.4	129	19	4.9	156	15	5.1	202	17	5.4	83	16	5.3
Gr 4	133	16	5.4	58	19	5.1	75	15	4.9	91	17	5.3	42	16	5.5
Gr 5	152	17	5.4	71	19	4.8	81	15	5.3	111	17	5.5	41	17	5.1
Male	129	19	4.9	-	-	-	-	-	-	87	19	5.1	42	18	4.5
Female	156	15	5.1	-	-	-	-	-	-	115	15	5.0	41	15	5.5
White	202	17	5.4	87	19	5.1	115	15	5.0	-	-	-	-	-	-
Minority	83	16	5.3	42	18	4.5	41	15	5.5	-	-	-	-	-	-

Table E.6 6-Dialogue Sample. 1977 Posttest General Science Interest Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	17	6.2	94	19	6.1	82	15	5.7	127	17	6.1	49	17	6.4
Gr 4	83	16	6.4	40	19	5.9	43	14	6.2	58	16	6.4	25	17	6.7
Gr 5	93	18	5.9	54	19	6.3	39	16	4.9	69	18	5.8	24	18	6.2
Male	94	19	6.1	-	-	-	-	-	-	65	19	6.2	29	19	6.1
Female	82	15	5.7	-	-	-	-	-	-	62	15	5.6	20	15	6.3
White	127	17	6.1	65	19	6.2	62	15	5.6	-	-	-	-	-	-
Minority	49	17	6.4	29	19	6.1	20	15	6.3	-	-	-	-	-	-
NO SCAT															
Total	109	16	6.1	35	18	6.0	74	15	6.0	75	16	6.2	34	15	6.0
Gr 4	50	17	5.8	18	20	4.6	32	15	5.5	33	17	5.6	17	16	6.1
Gr 5	59	15	6.3	17	15	6.2	42	14	6.4	42	15	6.5	17	14	5.9
Male	35	18	6.0	-	-	-	-	-	-	22	19	5.8	13	16	6.1
Female	74	15	6.0	-	-	-	-	-	-	53	15	6.0	21	14	6.0
White	75	16	6.2	22	19	5.8	53	15	6.0	-	-	-	-	-	-
Minority	34	15	6.0	13	16	6.1	21	14	6.0	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	17	6.2	129	18	6.1	156	15	5.8	202	17	6.1	83	16	6.4
Gr 4	133	16	6.2	58	19	5.6	75	15	5.9	91	17	6.1	42	16	6.4
Gr 5	152	17	6.2	71	18	6.5	81	15	5.8	111	17	6.2	41	16	6.4
Male	129	18	6.1	-	-	-	-	-	-	87	19	6.1	42	18	6.2
Female	156	15	5.8	-	-	-	-	-	-	115	15	5.7	41	15	6.1
White	202	17	6.1	87	19	6.1	115	15	5.7	-	-	-	-	-	-
Minority	83	16	6.4	42	18	6.2	41	15	6.1	-	-	-	-	-	-

Table E.7 6-Dialogue Sample. Results of the Analysis of Covariance of General Science Interest Scores Using 1977 Posttest as the Dependent Variable and 1977 Pretest as the Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	4849.51	227.89 **
	Main Effect			
	Treatment (TR)	1	34.00	1.598
	Grade (GR)	1	10.72	.504
	Sex	1	5.29	.248
	Interactions			
	TR x GR	1	3.30	.155
	TR x SEX	1	3.74	.176
	GR x SEX	1	62.20	2.923
	TR x GR x SEX	1	4.58	.215
	Residual	276	21.28	
	Raw Regression Coefficient		.767	
Treatment by Grade by Race	Covariate	1	4849.51	226.91 **
	Main Effect			
	Treatment (TR)	1	40.75	1.907
	Grade (GR)	1	10.35	.484
	Race (R)	1	.100	.005
	Interactions			
	TR x GR	1	.27	.012
	TR x R	1	37.98	1.777
	GR x R	1	1.99	.093
	TR x GR x R	1	10.41	.487
	Residual	276	21.37	
	Raw Regression Coefficient		.767	
Treatment by Sex by Race	Covariate	1	4849.51	226.55 **
	Main Effect			
	Treatment (TR)	1	34.85	1.628
	Sex	1	4.88	.228
	Race (R)	1	.06	.003
	Interactions			
	TR x SEX	1	7.950	.372
	TR x R	1	38.840	1.814
	SEX x R	1	.001	.000
	TR x SEX x R	1	0.820	.038
	Residual	276	21.41	
	Raw Regression Coefficient		.767	

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table E.8 6-Dialogue Sample. Adjusted Means of the Dependent Variable Resulting from the Analyses of Covariance

	Adjusted 1977 Posttest Means
SCAT	17
NO-SCAT	16
MALE	17
FEMALE	16
WHITE	16
MINORITY	17
GRADE 4	17
GRADE 5	16

Table E.9 6-Dialogue Sample. 1977 Pretest Interest in SCAT Careers Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	6.5	3.0	94	7.0	2.8	82	5.8	3.2	127	6.0	2.7	49	7.7	3.4
Gr 4	83	6.5	2.9	40	6.7	2.6	43	6.3	3.2	58	6.0	2.4	25	7.7	3.6
Gr 5	93	6.4	3.1	54	7.2	2.9	39	5.4	3.2	69	6.0	3.0	24	7.8	3.3
Male	94	7.0	2.8	-	-	-	-	-	-	65	6.4	2.5	29	8.3	2.9
Female	82	5.8	3.2	-	-	-	-	-	-	62	5.5	2.9	20	6.9	3.9
White	127	6.0	2.7	65	6.4	2.5	62	5.5	2.9	-	-	-	-	-	-
Minority	49	7.7	3.4	29	8.3	2.9	20	6.9	3.9	-	-	-	-	-	-
NO SCAT															
Total	109	5.0	3.5	35	5.3	3.4	74	4.8	3.5	75	4.8	3.3	34	5.4	3.8
Gr 4	50	5.8	3.5	18	6.2	3.5	32	5.6	3.5	33	5.4	3.3	17	6.6	3.7
Gr 5	59	4.3	3.3	17	4.3	3.1	42	4.3	3.5	42	4.3	3.2	17	4.2	3.7
Male	35	5.3	3.4	-	-	-	-	-	-	22	5.0	2.9	13	5.8	4.1
Female	74	4.8	3.5	-	-	-	-	-	-	53	4.7	3.5	21	5.2	3.8
White	75	4.8	3.3	22	5.0	2.9	53	4.7	3.5	-	-	-	-	-	-
Minority	34	5.4	3.8	13	5.8	4.1	21	5.2	3.8	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	6.0	3.3	129	6.5	3.0	156	5.4	3.4	202	5.5	3.0	83	6.8	3.8
Gr 4	133	6.3	3.2	58	6.6	2.9	75	6.0	3.4	91	5.8	2.8	42	7.3	3.7
Gr 5	152	5.6	3.4	71	6.5	3.2	81	4.8	3.4	111	5.3	3.2	41	6.3	3.8
Male	129	6.5	3.0	-	-	-	-	-	-	87	6.1	2.7	42	7.6	3.5
Female	156	5.4	3.4	-	-	-	-	-	-	115	5.1	3.2	41	6.0	3.9
White	202	5.5	3.0	87	6.1	2.7	115	5.1	3.2	-	-	-	-	-	-
Minority	83	6.8	3.8	42	7.6	3.5	41	6.0	3.9	-	-	-	-	-	-

Table E.10 6-Dialogue Sample. 1977 Posttest Interest in SCAT Careers Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	5.3	3.5	94	6.1	3.7	82	4.3	3.1	127	4.8	3.1	49	6.4	4.3
Gr 4	83	5.3	3.6	40	6.2	3.8	43	4.5	3.4	58	4.7	3.0	25	6.8	4.6
Gr 5	93	5.2	3.5	54	6.0	3.7	39	4.1	2.9	69	4.9	3.3	24	5.9	4.0
Male	94	6.1	3.7	-	-	-	-	-	-	65	5.5	3.1	29	7.3	4.5
Female	82	4.3	3.1	-	-	-	-	-	-	62	4.1	2.9	20	5.0	3.7
White	127	4.8	3.1	65	5.5	3.1	62	4.1	2.9	-	-	-	-	-	-
Minority	49	6.4	4.3	29	7.3	4.5	20	5.0	3.7	-	-	-	-	-	-
NO SCAT															
Total	109	4.4	3.7	35	4.4	3.9	74	4.5	3.6	75	4.4	3.7	34	4.5	3.7
Gr 4	50	4.6	3.5	18	4.3	3.9	32	4.7	3.3	33	4.4	3.2	17	4.9	4.1
Gr 5	59	4.3	3.8	17	4.5	4.0	42	4.3	3.8	42	4.4	4.0	17	4.1	3.3
Male	35	4.4	3.9	-	-	-	-	-	-	22	4.5	3.7	13	4.2	4.3
Female	74	4.5	3.6	-	-	-	-	-	-	53	4.4	3.7	21	4.6	3.4
White	75	4.4	3.7	22	4.5	3.7	53	4.4	3.7	-	-	-	-	-	-
Minority	34	4.5	3.7	13	4.2	4.3	21	4.6	3.4	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	4.9	3.6	129	5.6	3.8	156	4.4	3.4	202	4.7	3.3	83	5.6	4.1
Gr 4	133	5.1	3.6	58	5.6	3.9	75	4.6	3.3	91	4.6	3.1	42	6.0	4.4
Gr 5	152	4.8	3.6	71	5.6	3.8	81	4.2	3.4	111	4.7	3.6	41	5.2	3.8
Male	129	5.6	3.8	-	-	-	-	-	-	87	5.3	3.3	42	6.3	4.6
Female	156	4.4	3.4	-	-	-	-	-	-	115	4.2	3.3	41	4.8	3.5
White	202	4.7	3.3	87	5.3	3.3	115	4.2	3.3	-	-	-	-	-	-
Minority	83	5.6	4.1	42	6.3	4.6	41	4.8	3.5	-	-	-	-	-	-

Table E.11 6-Dialogue Sample. Results of Analyses of Covariance of Interest in SCAT Careers Scores Using 1977 Posttest as the Dependent Variable and 1977 Pretest as the Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	1249.42	146.99 **
	Main Effect			
	Treatment (TR)	1	3.66	.430
	Grade (GR)	1	2.07	.243
	Sex	1	18.96	2.227
	Interactions			
	TR x GR	1	13.39	1.573
	TR x SEX	1	27.55	3.237
	GR x SEX	1	.03	.004
	TR x GR x SEX	1	9.87	1.159
	Residual	276	8.51	
	Raw Regression Coefficient			.639
Treatment by Grade by Race	Covariate	1	1249.42	144.20 **
	Main Effect			
	Treatment (TR)	1	1.23	.142
	Grade (GR)	1	2.81	.324
	Race (R)	1	.48	.056
	Interactions			
	TR x GR	1	11.89	1.372
	TR x R	1	6.54	.775
	GR x R	1	5.88	.679
	TR x GR x R	1	3.60	.416
	Residual	276	8.66	
	Raw Regression Coefficient			.639
Treatment by Sex by Race	Covariate	1	1249.42	145.88 **
	Main Effect			
	Treatment (TR)	1	3.50	.409
	Sex	1	19.37	2.262
	Race (R)	1	.16	.019
	Interactions			
	TR x SEX	1	27.27	3.184
	TR x R	1	5.69	.664
	SEX x R	1	.01	.001
	TR x SEX x R	1	3.98	.464
	Residual	276	8.57	
	Raw Regression Coefficient			.639

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table E.12 6-Dialogue Sample. Adjusted Means of the Dependent Variable Resulting from the Analyses of Covariance

	Adjusted 1977 Posttest Means
SCAT	5
NO-SCAT	5
MALE	5
FEMALE	5
WHITE	5
MINORITY	5
GRADE 4	5
GRADE 5	5

Table E.13 1977 3-Dialogue Sample. 1977 Pretest Science Career Interest Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	192	5.3	2.6	92	5.6	2.3	100	5.1	2.2	165	5.3	2.2	27	5.2	2.5
Gr 4	119	5.4	2.3	58	5.9	2.2	61	4.9	2.3	101	5.4	2.3	18	5.3	2.3
Gr 5	41	5.1	2.3	19	5.1	2.6	22	5.1	2.1	36	5.1	2.1	5	5.2	4.0
Gr 6	32	5.4	2.0	15	5.1	2.0	17	5.7	2.1	28	5.5	2.0	4	4.8	2.2
Male	92	5.6	2.3	-	-	-	-	-	-	81	5.6	2.2	11	5.8	3.0
Female	100	5.1	2.2	-	-	-	-	-	-	84	5.1	2.2	16	4.8	2.2
White	165	5.3	2.2	81	5.6	2.2	84	5.1	2.2	-	-	-	-	-	-
Minority	27	5.2	2.5	11	5.8	3.0	16	4.8	2.2	-	-	-	-	-	-
NO SCAT															
Total	253	5.0	2.3	129	5.0	2.3	124	5.1	2.3	190	5.1	2.2	63	4.7	2.4
Gr 4	108	4.9	2.1	53	4.9	2.3	55	5.0	2.0	75	5.1	2.0	33	4.6	2.4
Gr 5	64	5.1	2.3	33	5.1	2.1	31	5.2	2.6	53	5.2	2.2	11	5.1	3.0
Gr 6	81	5.1	2.4	43	4.9	2.4	38	5.2	2.3	62	5.2	2.4	19	4.5	2.0
Male	129	5.0	2.3	-	-	-	-	-	-	102	5.1	2.2	27	4.3	2.5
Female	124	5.1	2.3	-	-	-	-	-	-	88	5.2	2.3	36	5.0	2.3
White	190	5.1	2.2	102	5.1	2.2	88	5.2	2.3	-	-	-	-	-	-
Minority	63	4.7	2.4	27	4.3	2.5	36	5.0	2.3	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	445	5.2	2.3	221	5.2	2.3	224	5.1	2.2	355	5.2	2.2	90	4.8	2.4
Gr 4	227	5.2	2.2	111	5.4	2.3	116	4.9	2.1	176	5.3	2.2	51	4.9	2.4
Gr 5	105	5.1	2.3	52	5.1	2.3	53	5.1	2.4	89	5.1	2.1	16	5.1	3.2
Gr 6	113	5.2	2.3	58	5.0	2.3	55	5.4	2.2	90	5.3	2.3	23	4.6	2.0
Male	221	5.2	2.3	-	-	-	-	-	-	183	5.3	2.2	38	4.7	2.7
Female	224	5.1	2.2	-	-	-	-	-	-	172	5.1	2.2	52	4.9	2.2
White	355	5.2	2.2	183	5.3	2.2	172	5.1	2.2	-	-	-	-	-	-
Minority	90	4.8	2.4	38	4.7	2.7	52	4.9	2.2	-	-	-	-	-	-

Table E.14

1977 3-Dialogue Sample. 1977 Posttest Science Career Interest Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	192	5.7	2.4	92	5.8	2.4	100	5.6	2.5	165	5.6	2.4	27	6.1	2.8
Gr 4	119	6.0	2.5	58	6.2	2.4	61	5.7	2.6	101	5.9	2.5	18	6.1	2.5
Gr 5	41	5.4	2.2	19	5.5	2.3	22	5.3	2.2	36	5.1	2.0	5	7.4	3.2
Gr 6	32	5.0	2.3	15	4.7	2.1	17	5.4	2.5	28	5.1	2.2	4	4.3	3.4
Male	92	5.8	2.4	-	-	-	-	-	-	81	5.7	2.3	11	6.7	3.0
Female	100	5.6	2.5	-	-	-	-	-	-	84	5.5	2.4	16	5.7	2.7
White	165	5.6	2.4	81	5.7	2.3	84	5.5	2.4	-	-	-	-	-	-
Minority	27	6.1	2.8	11	6.7	3.0	16	5.7	2.7	-	-	-	-	-	-
NO SCAT															
Total	253	4.8	2.8	129	4.8	2.8	124	4.8	2.8	190	4.9	2.8	63	4.7	2.9
Gr 4	108	4.8	2.6	53	4.7	2.7	55	4.8	2.6	75	5.0	2.4	33	4.3	3.1
Gr 5	64	5.4	2.8	33	5.4	2.5	31	5.3	3.2	53	5.3	2.7	11	5.6	3.4
Gr 6	81	4.4	2.9	43	4.5	3.1	38	4.3	2.7	62	4.3	3.1	19	4.8	2.3
Male	129	4.8	2.8	-	-	-	-	-	-	102	4.9	2.7	27	4.7	3.2
Female	124	4.8	2.8	-	-	-	-	-	-	88	4.8	2.8	36	4.7	2.8
White	190	4.9	2.8	102	4.9	2.7	88	4.8	2.8	-	-	-	-	-	-
Minority	63	4.7	2.9	27	4.7	3.2	26	4.7	2.8	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	445	5.2	2.7	221	5.2	2.7	224	5.1	2.7	355	5.2	2.6	90	5.1	3.0
Gr 4	227	5.4	2.6	111	5.5	2.7	116	5.3	2.6	176	5.5	2.5	51	5.0	3.0
Gr 5	105	5.4	2.6	52	5.4	2.4	53	5.3	2.8	89	5.3	2.4	16	6.1	3.4
Gr 6	113	4.6	2.8	58	4.5	2.9	55	4.6	2.7	90	4.5	2.8	23	4.7	2.5
Male	221	5.2	2.7	-	-	-	-	-	-	183	5.2	2.6	38	5.3	3.2
Female	224	5.1	2.7	-	-	-	-	-	-	172	5.2	2.7	52	5.0	2.8
White	355	5.2	2.6	183	5.2	2.6	172	5.2	2.7	-	-	-	-	-	-
Minority	90	5.1	3.0	38	5.3	3.2	52	5.0	2.8	-	-	-	-	-	-

Table E.15 1977 3-Dialogue Sample. Results of Analyses of Covariance of Science Career Interest Scores Using 1977 Posttest as the Dependent Variable and 1977 Pretest as the Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	983.67	204.58**
	Main Effect			
	Treatment (TR)	1	35.93	7.473*
	Grade (GR)	2	20.33	4.23 *
	Sex	1	.19	.04
	Interactions			
	TR x GR	2	6.16	1.28
	TR x SEX	1	1.14	.24
	GR x SEX	2	.61	.13
	TR x GR x SEX	2	.92	.19
	Residual	432	4.81	
	Raw Regression Coefficient			.660
Treatment by Grade by Race	Covariate	1	983.67	208.39**
	Main Effect			
	Treatment (TR)	1	38.89	8.24 *
	Grade (GR)	2	20.17	4.27 *
	Race (R)	1	4.91	1.04
	Interactions			
	TR x GR	2	4.48	.950
	TR x R	1	4.31	.912
	GR x R	2	8.84	1.872
	TR x GR x R	2	8.68	1.838
	Residual	432	4.72	
	Raw Regression Coefficient			.660
Treatment by Sex by Race	Covariate	1	983.67	202.07**
	Main Effect			
	Treatment (TR)	1	54.79	11.254**
	Sex	1	.28	.058
	Race (R)	1	5.33	1.094
	Interactions			
	TR x SEX	1	.82	.169
	TR x R	1	2.87	.590
	SEX x R	1	2.97	.610
	TR x SEX x R	1	.11	.023
	Residual	436	4.87	
	Raw Regression Coefficient			.660

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table E.16 1977 3-Dialogue Sample. Adjusted Means of the Dependent Variable Resulting from the Analyses of Covariance

	Adjusted 1977 Posttest Means
SCAT	6
NO-SCAT	5
MALE	5
FEMALE	5
WHITE	5
MINORITY	5
GRADE 4	5
GRADE 5	5
GRADE 6	5

Table E.17

1977 3-Dialogue Sample. 1977 Pretest General Science Interest Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	192	17	4.9	92	18	4.6	100	15	4.7	165	17	4.6	27	16	6.3
Gr 4	119	17	5.1	58	19	4.2	61	14	4.9	101	17	5.0	18	16	5.5
Gr 5	41	16	4.5	19	17	4.8	22	16	4.3	36	17	3.5	5	14	9.0
Gr 6	32	16	4.6	15	16	5.4	17	16	4.0	28	16	4.4	4	17	7.1
Male	92	18	4.6	-	-	-	-	-	-	81	18	4.2	11	18	7.5
Female	100	15	4.7	-	-	-	-	-	-	84	15	4.6	16	15	5.1
White	165	17	4.6	81	18	4.2	84	15	4.6	-	-	-	-	-	-
Minority	27	16	6.3	11	18	7.5	16	15	5.1	-	-	-	-	-	-
NO SCAT															
Total	253	16	5.5	129	16	6.0	124	15	4.9	190	16	5.2	63	14	6.4
Gr 4	108	15	5.3	53	16	6.0	55	15	4.4	75	16	4.8	33	14	6.0
Gr 5	64	15	5.8	33	16	6.5	31	14	5.0	53	15	5.1	11	13	8.8
Gr 6	81	16	5.5	43	17	5.8	38	16	5.3	62	16	5.7	19	17	5.2
Male	129	16	6.0	-	-	-	-	-	-	102	17	5.5	27	14	7.2
Female	124	15	4.9	-	-	-	-	-	-	88	15	4.5	36	15	5.8
White	190	16	5.2	102	17	5.5	88	15	4.5	-	-	-	-	-	-
Minority	63	14	6.4	27	14	7.2	36	15	5.8	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	445	16	5.3	221	17	5.5	224	15	4.8	355	16	4.9	90	15	6.4
Gr 4	227	16	5.2	111	18	5.3	116	15	4.7	176	17	4.9	51	15	5.9
Gr 5	105	15	5.4	52	16	5.9	53	15	4.8	89	16	4.6	16	13	8.5
Gr 6	113	16	5.3	58	17	5.6	55	16	4.9	90	16	5.3	23	17	5.4
Male	221	17	5.5	-	-	-	-	-	-	183	17	5.0	38	15	7.4
Female	224	15	4.8	-	-	-	-	-	-	172	15	4.5	52	15	5.6
White	355	16	4.9	183	17	5.0	172	15	4.5	-	-	-	-	-	-
Minority	90	15	6.4	38	15	7.4	52	15	5.6	-	-	-	-	-	-

Table E.18 1977 3-Dialogue Sample. 1977 Posttest General Science Interest Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	192	17	5.9	92	18	5.3	100	16	6.2	165	17	5.5	27	17	7.7
Gr 4	119	18	6.1	58	19	5.4	61	16	6.6	101	18	6.0	18	17	7.1
Gr 5	41	17	4.9	19	18	4.3	22	16	5.4	36	17	4.5	5	19	7.6
Gr 6	32	16	5.9	15	16	5.6	17	16	6.3	28	16	5.0	4	14	11.5
Male	92	18	5.3	-	-	-	-	-	-	81	18	5.1	11	20	6.5
Female	100	16	6.2	-	-	-	-	-	-	84	17	5.8	16	15	8.0
White	165	17	5.5	81	18	5.1	84	17	5.8	-	-	-	-	-	-
Minority	27	17	7.7	11	20	6.5	16	15	8.0	-	-	-	-	-	-
NO SCAT															
Total	253	15	6.9	129	16	7.3	124	14	6.4	190	15	6.8	63	14	7.4
Gr 4	108	15	6.4	53	16	6.7	55	14	5.9	75	16	5.9	33	13	7.2
Gr 5	64	16	6.7	33	16	7.1	31	15	6.2	53	16	6.3	11	13	8.3
Gr 6	81	14	7.8	43	15	8.2	38	14	7.4	62	14	7.9	19	16	7.3
Male	129	16	7.3	-	-	-	-	-	-	102	16	7.1	27	14	7.9
Female	124	14	6.4	-	-	-	-	-	-	88	14	6.1	36	14	7.2
White	190	15	6.8	102	16	7.1	88	14	6.1	-	-	-	-	-	-
Minority	63	14	7.4	27	14	7.9	36	14	7.2	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	445	16	6.6	221	17	6.6	224	15	6.4	355	16	6.3	90	15	7.6
Gr 4	227	16	6.4	111	18	6.2	116	15	6.4	176	17	6.0	51	14	7.3
Gr 5	105	16	6.1	52	17	6.2	53	15	5.9	89	16	5.6	16	15	8.3
Gr 6	113	15	7.3	58	15	7.6	55	15	7.1	90	15	7.2	23	16	7.9
Male	221	17	6.6	-	-	-	-	-	-	183	17	6.4	38	16	7.9
Female	224	15	6.4	-	-	-	-	-	-	172	15	6.1	52	14	7.4
White	355	16	6.3	183	17	6.4	172	15	6.1	-	-	-	-	-	-
Minority	90	15	7.6	38	16	7.9	52	14	7.4	-	-	-	-	-	-

Table E.19 1977 3-Dialogue Sample. Results of Analyses of Covariance of General Science Interest Scores Using 1977 Posttest as the Dependent Variable and 1977 Pretest as the Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	5070.17	162.13**
	Main Effect			
	Treatment (TR)	1	266.43	8.52 *
	Grade (GR)	2	101.41	3.243*
	Sex	1	29.58	.946
	Interactions			
	TR x GR	2	13.96	.447
	TR x SEX	1	13.51	.432
	GR x SEX	2	3.02	.096
	TR x GR x SEX	2	28.68	.917
	Residual	432	31.27	
	Raw Regression Coefficient			.643
Treatment by Grade by Race	Covariate	1	5070.17	163.45**
	Main Effect			
	Treatment (TR)	1	249.92	8.057*
	Grade (GR)	2	101.32	3.266*
	Race (R)	1	.90	.029
	Interactions			
	TR x GR	2	14.16	.457
	TR x R	1	4.35	.140
	GR x R	2	30.90	.996
	TR x GR x R	2	75.27	2.426
	Residual	432	31.02	
	Raw Regression Coefficient			.643
Treatment by Sex by Race	Covariate	1	5070.17	160.75**
	Main Effect			
	Treatment (TR)	1	343.52	10.892**
	Sex	1	29.07	.922
	Race (R)	1	.55	.018
	Interactions			
	TR x SEX	1	6.48	.206
	TR x R	1	.95	.030
	SEX x R	1	16.78	.532
	TR x SEX x R	1	37.37	1.185
	Residual	436	31.54	
	Raw Regression Coefficient			.643

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table E.20 1977 3-Dialogue Sample. Adjusted Means of the Dependent Variable Resulting from the Analyses of Covariance

	Adjusted 1977 Posttest Means
SCAT	17
NO-SCAT	15
MALE	16
FEMALE	16
WHITE	16
MINORITY	16
GRADE 4	16
GRADE 5	17
GRADE 6	15

Table E.21 1977 3-Dialogue Sample. 1977 Pretest Interest in SCAT Careers Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	192	5.6	3.2	92	5.6	3.5	100	5.5	2.9	165	5.4	3.2	27	6.7	3.3
Gr 4	119	5.7	3.2	58	5.4	3.5	61	5.9	2.9	101	5.5	3.2	18	6.6	2.9
Gr 5	41	5.4	3.5	19	6.2	3.8	22	4.7	3.1	36	5.2	3.3	5	6.8	4.8
Gr 6	32	5.4	2.9	15	5.7	3.2	17	5.2	2.8	28	5.2	2.7	4	7.3	4.0
Male	92	5.6	3.5	-	-	-	-	-	-	81	5.3	3.4	11	8.1	3.0
Female	100	5.5	2.9	-	-	-	-	-	-	84	5.5	2.9	16	5.8	3.2
White	165	5.4	3.2	81	5.3	3.4	84	5.5	2.9	-	-	-	-	-	-
Minority	27	6.7	3.3	11	8.1	3.0	16	5.8	3.2	-	-	-	-	-	-
NO SCAT															
Total	253	5.3	3.5	129	5.2	3.8	124	5.3	3.3	190	4.8	3.4	63	6.5	3.8
Gr 4	108	5.7	3.5	53	5.4	3.7	55	5.9	3.4	75	5.1	3.3	33	7.0	3.7
Gr 5	64	5.2	3.7	33	5.3	4.3	31	5.2	3.0	53	5.2	3.7	11	5.5	4.2
Gr 6	81	4.8	3.3	43	4.9	3.4	38	4.6	3.3	62	4.3	3.1	19	6.3	3.7
Male	129	5.2	3.8	-	-	-	-	-	-	102	4.9	3.6	27	6.3	4.2
Female	124	5.3	3.3	-	-	-	-	-	-	88	4.8	3.1	36	6.7	3.5
White	190	4.8	3.4	102	4.9	3.6	88	4.8	3.1	-	-	-	-	-	-
Minority	63	6.5	3.8	27	6.3	4.2	36	6.7	3.5	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	445	5.4	3.4	221	5.4	3.6	224	5.4	3.1	355	5.1	3.3	90	6.6	3.6
Gr 4	227	5.7	3.4	111	5.4	3.6	116	5.9	3.1	176	5.3	3.3	51	6.9	3.4
Gr 5	105	5.3	3.6	52	5.6	4.1	53	5.0	3.0	89	5.2	3.5	16	5.9	4.2
Gr 6	113	5.0	3.2	58	5.1	3.3	55	4.8	3.2	90	4.6	3.0	23	6.5	3.7
Male	221	5.4	3.6	-	-	-	-	-	-	183	5.1	3.5	38	6.8	3.9
Female	224	5.4	3.1	-	-	-	-	-	-	172	5.1	3.0	52	6.4	3.4
White	355	5.1	3.3	183	5.1	3.5	172	5.1	3.0	-	-	-	-	-	-
Minority	90	6.6	3.6	38	6.8	3.9	52	6.4	3.4	-	-	-	-	-	-

Table E.22 1977 3-Dialogue Sample. 1977 Posttest Interest in SCAT Careers Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	192	5.7	3.4	92	5.6	3.9	100	5.7	3.0	165	5.6	3.4	27	6.2	3.6
Gr 4	119	5.8	3.6	58	5.7	4.0	61	5.8	3.1	101	5.6	3.6	18	6.6	3.4
Gr 5	41	5.7	3.0	19	5.3	3.8	22	6.1	2.3	36	5.7	3.1	5	5.8	3.3
Gr 6	32	5.3	3.5	15	5.7	3.9	17	4.9	3.2	28	5.4	3.2	4	4.8	5.6
Male	92	5.6	3.9	-	-	-	-	-	-	81	5.4	3.8	11	7.7	3.8
Female	100	5.7	3.0	-	-	-	-	-	-	84	5.9	2.9	16	5.1	3.2
White	165	5.6	3.4	81	5.4	3.8	84	5.9	2.9	-	-	-	-	-	-
Minority	27	6.2	3.6	11	7.7	3.8	16	5.1	3.2	-	-	-	-	-	-
NO SCAT															
Total	253	4.4	3.7	129	4.2	3.9	124	4.5	3.6	190	4.1	3.5	63	5.2	4.4
Gr 4	108	4.6	3.6	53	4.5	3.6	55	4.8	3.6	75	4.4	3.3	33	5.2	4.2
Gr 5	64	4.6	3.9	33	5.1	4.5	31	4.0	2.9	53	4.8	3.9	11	3.6	3.8
Gr 6	81	3.8	3.9	43	3.2	3.5	38	4.5	4.2	62	3.1	3.2	19	6.2	4.9
Male	129	4.2	3.9	-	-	-	-	-	-	102	4.1	3.8	27	4.7	4.3
Female	124	4.5	3.6	-	-	-	-	-	-	88	4.1	3.1	36	5.6	4.5
White	190	4.1	3.5	102	4.1	3.8	88	4.1	3.1	-	-	-	-	-	-
Minority	63	5.2	4.4	27	4.7	4.3	36	5.6	4.5	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	445	4.9	3.7	221	4.8	3.9	224	5.1	3.4	355	4.8	3.5	90	5.5	4.2
Gr 4	227	5.2	3.6	111	5.1	3.8	116	5.3	3.4	176	5.1	3.5	51	5.7	4.0
Gr 5	105	5.0	3.6	52	5.2	4.2	53	4.9	2.8	89	5.1	3.6	16	4.3	3.7
Gr 6	113	4.3	3.8	58	3.9	3.7	55	4.7	3.9	90	3.8	3.4	23	5.9	4.9
Male	221	4.8	3.9	-	-	-	-	-	-	183	4.7	3.8	38	5.6	4.3
Female	224	5.1	3.4	-	-	-	-	-	-	172	4.9	3.1	52	5.5	4.1
White	355	4.8	3.5	183	4.7	3.8	172	4.9	3.1	-	-	-	-	-	-
Minority	90	5.5	4.2	38	5.6	4.3	52	5.5	4.1	-	-	-	-	-	-

Table E.23 1977 3-Dialogue Sample. Results of Analysis of Covariance of Interest in SCAT Careers Scores Using 1977 Posttest as the Dependent Variable and 1977 Pretest as the Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	1757.90	191.99**
	Main Effect			
	Treatment (TR)	1	125.32	13.687**
	Grade (GR)	2	6.09	.665
	Sex	1	3.15	.344
	Interactions			
	TR x GR	2	.11	.012
	TR x SEX	1	.47	.051
	GR x SEX	2	9.82	1.073
	TR x GR x SEX	2	33.93	3.705*
	Residual	432	9.16	
	Raw Regression Coefficient			.587
Treatment by Grade by Race	Covariate	1	1757.90	191.78**
	Main Effect			
	Treatment (TR)	1	124.65	13.599**
	Grade (GR)	2	6.19	.675
	Race (R)	1	.10	.011
	Interactions			
	TR x GR	2	.34	.038
	TR x R	1	1.05	.114
	GR x R	2	21.15	2.307
	TR x GR x R	2	20.50	2.236
	Residual	432	9.17	
	Raw Regression Coefficient			.587
Treatment by Sex by Race	Covariate	1	1757.90	190.20**
	Main Effect			
	Treatment (TR)	1	137.23	14.848**
	Sex	1	3.25	.352
	Race (R)	1	.01	.001
	Interactions			
	TR x SEX	1	.01	.002
	TR x R	1	2.56	.276
	SEX x R	1	.16	.018
	TR x SEX x R	1	22.96	2.484
	Residual	436	9.24	
	Raw Regression Coefficient			.587

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table E.24 1977 3-Dialogue Sample. Adjusted Means of the Dependent Variable Resulting from the Analyses of Covariance

	Adjusted 1977 Posttest Means
SCAT	6
NO-SCAT	4
MALE	5
FEMALE	5
WHITE	5
MINORITY	5
GRADE 4	5
GRADE 5	5
GRADE 6	5

APPENDIX F

Numbers and Percentages of Students Choosing Careers in the Different Science Categories on Pretest 1976 for the 1976 3-Dialogue Sample and on Pretest 1977 for the 1977 3-Dialogue Sample

Table F.1 Numbers and Percentages of Students Choosing Careers in the Different Science Categories

Table F.1 1976 3-Dialogue Sample and 1977 3-Dialogue Sample
Numbers and Percentages of Students Choosing Careers
in the Different Science Categories at Pretest

	Female		Male		White		Nonwhite	
Biological Sciences								
Biologist	10	52.6	4	36.4	12	44.4	2	66.7
Botanist	1	5.3	0	0.0	1	3.7	0	0.0
Ecologist	0	0.0	1	9.1	1	3.7	0	0.0
Geneticist	1	5.3	0	0.0	1	3.7	0	0.0
Herpetologist	1	5.3	0	0.0	1	3.7	0	0.0
Ichthyologist	1	5.3	1	9.1	1	3.7	1	33.3
Paleontologist	0	0.0	2	18.2	2	7.4	0	0.0
Zoologist	5	26.3	3	27.3	8	29.6	0	0.0
	19	10[illegible]	11	100%	27	100%	3	100%
Earth Sciences								
Geologist	0	0.0	3	42.9	3	42.9	0	0.0
Oceanographer	2	100.0	4	57.1	4	57.1	2	100.0
	2	100%	7	100%	7	100%	2	100%
Engineering								
Architect	6	85.7	7	36.8	8	53.3	5	45.5
Engineer	1	14.3	12	63.2	7	46.7	6	54.5
	7	100%	19	100%	15	100%	11	100%
Health Sciences								
Dentist	3	1.7	9	13.0	12	6.9	0	0.0
Doctor	65	36.5	42	60.9	63	36.2	44	60.3
Lab Technician	1	0.6	1	1.4	2	1.1	0	0.0
Nurse	60	33.7	0	0.0	41	23.6	19	26.0
Optician	1	0.6	0	0.0	1	0.6	0	0.0
Paramedic	0	0.0	2	2.9	2	1.1	0	0.0
Pathologist	1	0.6	0	0.0	1	0.6	0	0.0
Pharmacist	1	0.6	0	0.0	1	0.6	0	0.0
Physical Therapist	1	0.6	0	0.0	1	0.6	0	0.0
Veterinarian	45	25.3	15	21.7	50	28.7	10	13.7
	178	100%	69	100%	174	100%	73	100%

Mathematics

	Female	Male	White	Nonwhite
Computer programmer	3 75.0	3 60.0	3 60.0	3 75.0
Mathematician	1 25.0	2 40.0	2 40.0	1 25.0
	4 100%	5 100%	5 100%	4 100%

Physics

Physicist	1 25.0	3 9.7	3 10.3	1 16.7
Space Scientist	3 75.0	28 90.3	26 89.7	5 83.3
	4 100%	31 100%	29 100%	6 100%

Social Sciences

Archeologist	8 88.9	5 71.4	13 86.7	0 0.0
Egyptologist	0 0.0	1 14.3	1 6.7	0 0.0
Psychologist	1 11.1	1 14.3	1 6.7	1 100.0
	9 100%	7 100%	15 100%	1 100%

APPENDIX G

Results of Analyses of Covariance of Career Maturity Scores for the 1976-77 6-Dialoque Sample

Tables G.1-2	Means and Standard Deviations of 1976 Pretest and 1977 Posttest by Treatment Group, Grade, Sex and Race
Table G.3	Results (F-Ratios) of Analyses of Covariance
Table G.4	Adjusted Means Resulting from Analyses of Covariance

Table G.1 6-Dialogue Sample. 1976 Pretest Career Maturity Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	27	5.4	94	27	5.2	82	26	5.6	127	27	5.1	49	26	6.0
Gr 4	83	26	4.4	40	26	4.1	43	25	4.7	58	26	4.2	25	25	4.8
Gr 5	93	27	6.1	54	28	5.8	39	27	6.4	69	28	5.7	24	27	7.1
Male	94	27	5.2	-	-	-	-	-	-	65	28	4.9	29	26	5.7
Female	82	26	5.6	-	-	-	-	-	-	62	27	5.3	20	25	6.6
White	127	27	5.1	65	28	4.9	62	27	5.3	-	-	-	-	-	-
Minority	49	26	6.0	29	26	5.7	20	25	6.6	-	-	-	-	-	-
NO SCAT															
Total	109	26	5.9	35	25	6.2	74	26	5.8	75	26	5.6	34	24	6.4
Gr 4	50	25	4.6	18	25	5.1	32	25	4.4	33	25	4.2	17	25	5.5
Gr 5	59	26	6.8	17	25	7.3	42	27	6.5	42	27	6.4	17	24	7.4
Male	35	25	6.2	-	-	-	-	-	-	22	26	4.9	13	23	7.8
Female	74	26	5.8	-	-	-	-	-	-	53	26	5.9	21	25	5.5
White	75	26	5.6	22	26	4.9	53	26	5.9	-	-	-	-	-	-
Minority	34	24	6.4	13	23	7.8	21	25	5.5	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	26	5.6	129	27	5.6	156	26	5.7	202	27	5.3	83	25	6.2
Gr 4	133	25	4.5	58	26	4.4	75	25	4.6	91	26	4.2	42	25	5.0
Gr 5	152	27	6.4	71	27	6.3	81	27	6.5	111	27	6.0	41	26	7.2
Male	129	27	5.6	-	-	-	-	-	-	87	27	4.9	42	25	6.4
Female	156	26	5.7	-	-	-	-	-	-	115	26	5.6	41	25	6.0
White	202	27	5.3	87	27	4.9	115	26	5.6	-	-	-	-	-	-
Minority	83	25	6.2	42	25	6.4	41	25	6.0	-	-	-	-	-	-

Table G.2 6-Dialogue Sample. 1977 Posttest Career Maturity Score N's, Means and Standard Deviations for SCAT, NO-SCAT and Total Samples by Grade, Sex and Race

	TOTAL			MALE			FEMALE			WHITE			MINORITY		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
SCAT															
Total	176	29	7.3	94	29	7.4	82	29	7.3	127	29	7.1	49	28	7.7
Gr 4	83	28	8.3	40	28	8.0	43	28	8.7	58	28	8.8	25	27	7.1
Gr 5	93	30	6.2	54	29	7.0	39	31	4.8	69	30	5.2	24	29	8.3
Male	94	29	7.4	-	-	-	-	-	-	65	30	7.2	29	27	7.7
Female	82	29	7.3	-	-	-	-	-	-	62	29	7.1	20	28	7.7
White	127	29	7.1	65	30	7.2	62	29	7.1	-	-	-	-	-	-
Minority	49	28	7.7	29	27	7.7	20	28	7.7	-	-	-	-	-	-
NO SCAT															
Total	109	31	8.8	35	29	9.2	74	32	8.6	75	32	7.7	34	28	10.4
Gr 4	50	30	7.9	18	30	7.2	32	30	8.4	33	31	6.5	17	28	9.8
Gr 5	59	31	9.6	17	28	11.1	42	32	8.7	42	32	8.6	17	28	11.3
Male	35	29	9.2	-	-	-	-	-	-	22	30	8.4	13	27	10.6
Female	74	32	8.6	-	-	-	-	-	-	53	33	7.3	21	28	10.6
White	75	32	7.7	22	30	8.4	53	33	7.3	-	-	-	-	-	-
Minority	34	28	10.4	13	27	10.6	21	28	10.6	-	-	-	-	-	-
SCAT plus NO SCAT															
Total	285	30	7.9	129	29	7.9	156	30	8.0	202	30	7.4	83	28	8.9
Gr 4	133	29	8.2	58	29	7.7	75	29	8.6	91	29	8.1	42	27	8.2
Gr 5	152	30	7.7	71	29	8.1	81	32	7.1	111	31	6.7	41	28	9.5
Male	129	29	7.9	-	-	-	-	-	-	87	30	7.5	42	27	8.6
Female	156	30	8.0	-	-	-	-	-	-	115	31	7.4	41	28	9.2
White	202	30	7.4	87	30	7.5	115	31	7.4	-	-	-	-	-	-
Minority	83	28	8.9	42	27	8.6	41	28	9.2	-	-	-	-	-	-

Table G.3 6-Dialogue Sample. Results of Analyses of Covariance of Career Maturity Scores Using 1977 Posttest as the Dependent Variable and 1976 Pretest as the Covariate

TYPE OF ANALYSIS OF COVARIANCE	SOURCE OF VARIATION	Df	MS	F - RATIOS
Treatment by Grade by Sex	Covariate	1	2757.80	52.47**
	Main Effect			
	Treatment (TR)	1	250.80	4.772*
	Grade (GR)	[illegible]	57.72	1.098
	Sex	1	123.63	2.352
	Interactions			
	TR x GR	1	41.94	.798
	TR x SEX	1	20.63	.393
	GR x SEX	1	68.76	1.308
	TR x GR x SEX	1	17.62	.335
	Residual	276	52.56	
	Raw Regression Coefficient			.555
Treatment by Grade by Race	Covariate	1	2757.80	52.47**
	Main Effect			
	Treatment (TR)	1	354.36	6.742*
	Grade (GR)	1	46.24	.880
	Race (R)	1	170.07	3.236
	Interactions			
	TR x GR	1	19.23	.366
	TR x R	1	63.71	1.212
	GR x R	1	.19	.004
	TR x GR x R	1	3.68	.070
	Residual	276	52.56	
	Raw Regression Coefficient			.555
Treatment by Sex by Race	Covariate	1	2757.80	52.94 **
	Main Effect			
	Treatment (TR)	1	274.17	5.263*
	Sex	1	96.67	1.856
	Race (R)	1	154.59	2.968
	Interactions			
	TR x SEX	1	19.51	.375
	TR x R	1	46.44	.892
	SEX x R	1	3.08	.059
	TR x SEX x R	1	79.61	1.528
	Residual	276	52.09	
	Raw Regression Coefficient			.555

Level of significance: * $p \leq .05$; ** $p \leq .01$

Table G.4 6-Dialogue Sample. Adjusted Means of the Dependent Variable Resulting from the Analyses of Covariance

	Adjusted 1977 Posttest Means
SCAT	29
NO-SCAT	31
MALE	29
FEMALE	30
WHITE	30
MINORITY	28
GRADE 4	29
GRADE 5	30

APPENDIX H

Percentages of Students Scoring High/Low on Knowledge and Math Competency Who Chose Science Careers for the 1976-77 6-Dialogue Sample

Table H.1	Percentages of High/Low Scorers on Knowledge about Science Careers and Math Competency Who Chose Science Careers

Table H.1 1976-1977 6-dialogue Sample. Percentages of High/Low Scorers in Knowledge About Scientists or Math Competency Who Chose A Science or Science-Related Career

	Pretest 76		Posttest 76		Pretest 77		Posttest 77	
	%SCAT	%NOSCAT	%SCAT	%NOSCAT	%SCAT	%NOSCAT	%SCAT	%NOSCAT
HIGH SCORES								
ITBS Concepts								
4th Grade	41.7	45.5	41.7	45.5	44.1	70.0	41.2	70.0
5th Grade	51.5	-	48.5	-	60.0	-	58.1	-
ITBS Problem Solving								
4th Grade	32.4	50.0	29.4	50.0	36.4	50.0	37.5	62.5
5th Grade	53.3	-	53.3	-	48.1	-	39.3	-
Knowledge about Scientists								
4th Grade	54.3	44.4	44.4	29.6	53.3	57.1	50.0	54.5
5th Grade	51.2	47.4	52.2	53.3	60.0	63.6	57.5	54.5
LOW SCORES								
ITBS Concepts								
4th Grade	27.8	31.3	44.4	18.7	37.5	43.7	41.2	40.0
5th Grade	14.8	-	29.6	-	44.4	-	46.2	-
ITBS Problem Solving								
4th Grade	11.8	36.4	35.3	18.2	33.3	45.5	41.2	45.5
5th Grade	36.0	-	44.0	-	64.0	-	58.3	-
Knowledge about Scientists								
4th Grade	25.0	36.4	40.9	36.4	22.2	44.4	31.6	38.9
5th Grade	36.4	18.2	22.2	35.5	45.5	35.3	44.4	50.0

APPENDIX I

Results of ITBS Mathematics Correlations for the 6-Dialogue Sample

Table I.1	Correlations of ITBS Math Concepts Scores with Knowledge Test Scores, Interest Test Scores and Career Maturity Scores
Table I.2	Correlations of ITBS Math Problem Solving Scores with Knowledge Test Scores, Interest Test Scores and Career Maturity Scores

Table I.1 1976-77 6-Dialogue Sample. Correlations of ITBS Math Concepts With Knowledge about Science Careers, Interest in Science as a Career and Career Maturity

	1976		1977	
	Pretest	Posttest	Pretest	Posttest
Knowledge About Science Careers				
4th Grade Total	.38**	.46**	.33**	.42**
5th Grade Total	.27**	.43**	.28**	.41**
4th Grade SCAT	.39**	.46**	.33**	.37**
5th Grade SCAT	.52**	.47**	.48**	.51**
4th Grade No-SCAT	.35**	.41**	.29*	.50**
5th Grade No-SCAT				
Science Career Choice				
4th Grade Total	-.10	-.04	.03	.09
5th Grade Total	-.15*	-.05	.15	.14
4th Grade SCAT	-.10	.02	.04	.08
5th Grade SCAT	-.21	-.06	-.05	.04
4th Grade No-SCAT	-.12	-.17	.07	.12
5th Grade No-SCAT	-	-	-	-
Science Career Interest				
4th Grade Total	-	-	.06	.10
5th Grade Total	-	-	.17*	.20**
4th Grade SCAT	-	-	.10	.14
5th Grade SCAT	-	-	.29**	.18*
4th Grade No-SCAT	-	-	.01	.06
5th Grade No-SCAT	-	-	-	-
Interest In SCAT Careers				
4th Grade Total	-	-	.13	.09
5th Grade Total	-	-	.26**	.25**
4th Grade SCAT	-	-	.13	.09
5th Grade SCAT	-	-	-.03	.06
4th Grade No-SCAT	-	-	.20	.34
5th Grade No-SCAT	-	-	-	-
Career Maturity				
4th Grade Total	.18*	-	-	.36**
5th Grade Total	.22**	-	-	.05
4th Grade SCAT	.22*	-	-	.39**
5th Grade SCAT	.44**	-	-	.49**
4th Grade No-SCAT	.06	-	-	.37**
5th Grade No-SCAT	-	-	-	-

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* $p \leq .05$; ** $p \leq .01$

Table I.2 1976-77 6-Dialogue Sample. Correlations of ITBS Math Problem Solving with Knowledge about Science Careers, Interest in Science as a Career and Career Maturity

	1976		1977	
	Pretest	Posttest	Pretest	Posttest
Knowledge About Science Careers				
4th Grade Total	.30**	.47**	.33**	.38**
5th Grade Total	.26**	.43**	.28**	.41**
4th Grade SCAT	.33**	.49**	.32**	.37**
5th Grade SCAT	.50**	.48**	.49**	.52**
4th Grade No-SCAT	.24**	.43**	.34**	.40**
5th Grade No-SCAT	-	-	-	-
Science Career Choice				
4th Grade Total	-.08	-.01	.03	.10
5th Grade Total	-.11	-.04	.11	.13
4th Grade SCAT	-.10	.04	.01	.08
5th Grade SCAT	-.10	-.05	-.17	-.12
4th Grade No-SCAT	-.06	-.12	.10	.16
5th Grade No-SCAT	-	-	-	-
Science Career Interest				
4th Grade Total	-	-	-.01	.02
5th Grade Total	-	-	.13	.17*
4th Grade SCAT	-	-	.03	.08
5th Grade SCAT	-	-	.15	.05
4th Grade No-SCAT	-	-	-.08	-.09
5th Grade No-SCAT	-	-	-	-
Interest In SCAT Careers				
4th Grade Total	-	-	-.06	.10
5th Grade Total	-	-	.28**	.07
4th Grade SCAT	-	-	-.03	.18
5th Grade SCAT	-	-	-.04	-.12
4th Grade No-SCAT	-	-	-.17	-.14
5th Grade No-SCAT	-	-	-	-
Career Maturity				
4th Grade Total	.17*	-	-	.36**
5th Grade Total	.19**	-	-	.06
4th Grade SCAT	.18*	-	-	.38**
5th Grade SCAT	.36**	-	-	.53**
4th Grade No-SCAT	.11	-	-	.38**
5th Grade No-SCAT	-	-	-	-

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* $p \leq .05$; ** $p \leq .01$